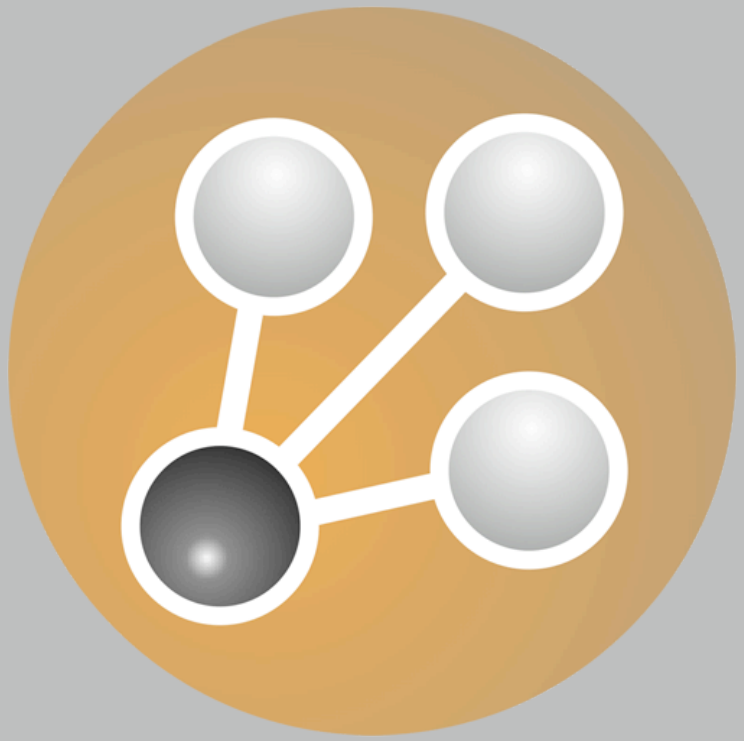

Adding eScience Assets to the Data Web

Herbert Van de Sompel - Los Alamos National Lab

Carl Lagoze - Cornell University

Michael Nelson - Old Dominion University

Simeon Warner - Cornell University

Robert Sanderson - University of Liverpool

Pete Johnston - Eduserv Foundation

http://www.openarchives.org/ore/toc

OAI-ORE was funded by:
The Andrew W. Mellon Foundation, the National Science Foundation, JISC, and Microsoft

Context

- Our paper reports on the outcome of the Open Archives Initiative Object Reuse & Exchange (OAI-ORE) standardization effort.

- In OAI-ORE, we have used Linked Data principles to address a problem that commonly occurs in contemporary scholarly communication:
  - It used to be that the *unit of communication* was a paper;
  - It used to be that the paper was held in your library;
  - Now, a *unit of communication* is the aggregation of multiple items; for example: a paper, a video, a dataset, software, etc.
  - And all those items are Web resources;

- These aggregations need to be unambiguously identified and described in order for them to be cite-able, reusable, …

Context

- The problem is known in the Digital Library community as the *compound digital object* problem.
- Several *packaging* approaches aimed at interoperability for compound digital objects have been explored: METS, MPEG-21 DIDL, IMS/CP, …
- OAI-ORE is the first to tackle the problem in a manner that uses the Web Architecture, and concepts from the Semantic Web and Linked data as its foundation.

Aggregations in eScience

2006 Astrophysics paper

ENTROPY PROFILES IN THE CORES OF COOLING FLOW CLUSTERS OF GALAXIES

Megan Donahue,[1] Donald J. Horner,[2] Kenneth W. Cavagnolo,[1] and G. Mark Voit[1]

Received 2005 July 13; accepted 2006 February 6

ABSTRACT

The X-ray properties of a relaxed cluster of galaxies are determined primarily by its gravitational potential well and the entropy distribution of its intracluster gas. That entropy distribution reflects both the accretion history of the cluster and the feedback processes that limit the condensation of intracluster gas. Here we present *Chandra* observations of the core entropy profiles of nine classic "cooling flow" clusters that appear relatively relaxed (at least outside the central 10–20 kpc) and contain intracluster gas with a cooling time less than a Hubble time. We show that those entropy profiles are remarkably similar, despite the fact that the clusters range over a factor of 3 in temperature. They typically have an entropy level of $\approx$130 keV cm^2 at 100 kpc that declines to a plateau $\sim$10 keV cm^2 at $\lesssim$10 kpc. Between these radii, the entropy profiles are $\propto r^{\alpha}$ with $\alpha \approx 1.0$–1.3. The nonzero central entropy levels in these clusters correspond to a cooling time $\sim 10^9$ yr, suggesting that episodic heating on this timescale maintains the central entropy profile in a quasi–steady state. We show in an appendix that although disturbances and bubbles are visible in the central regions of these clusters, these phenomena do not strongly bias our entropy estimates.

Subject headings: catalogs — cosmology: observations — galaxies: clusters: general — methods: data analysis — X-rays: galaxies: clusters

Online material: color figures

1. INTRODUCTION

The global properties of a cluster of galaxies, such as its bolometric X-ray luminosity L_X and its mean temperature T_X, are determined primarily by the mass M_{vir} within a suitably chosen virial radius. A cluster's temperature depends on mass because mass determines the depth of the cluster's potential well. Its X-ray luminosity depends on mass because mass determines both the total number of baryons in the cluster and the potential well confining those baryons. However, several secondary factors combine to produce a dispersion in both L_X and T_X at a fixed M_{vir}, and understanding the nature of that dispersion is crucial to doing precision cosmology with clusters. One of those factors is merger shocks, which can temporarily raise both the luminosity and best-fitting temperature of a cluster (e.g., Randall et al. 2002). A second is the shape of the potential well, because clusters whose potentials are more centrally concentrated tend to have higher central temperatures (e.g., Voit et al. 2002). A third factor is the amount of intracluster gas with a cooling time less than the age of the universe. The presence of such gas leads to both a large peak in the central surface brightness of a cluster and a central temperature gradient that rises with radius. Consequently, clusters having larger amounts of gas with a short cooling time tend to have higher L_X and lower T_X at a given value of M_{vir} (Allen & Fabian 1998; Fabian et al. 1994; Markevitch 1998).

Such clusters have often been called "cooling flow clusters" because the central gas was thought to condense and flow toward the center of the cluster as it radiated away its thermal energy (for a recent review see Donahue & Voit 2004). Observations from *Chandra* and *XMM-Newton* now show that the central gas is not simply cooling to low temperatures and condens

manner originally envisioned (e.g., Peterson et al. 2001, 2003). Some form of feedback apparently prevents the central gas from condensing and forming stars, thereby truncating the high end of the galaxy luminosity function. The nature of that feedback is currently an active topic of both observational and theoretical research, focusing largely on the role of outflows from active galactic nuclei (AGNs) in cluster cores.

This paper analyzes archival *Chandra* data on nine cooling flow clusters seeking clues to what keeps that gas from condensing and why clusters of a given mass have different amounts of gas with a short central cooling time. The tactic we take in our analysis is to focus on the entropy profiles of these clusters. We concentrate on entropy because it is a more fundamental property of the intracluster medium (ICM) itself than either temperature or density alone. For example, the temperature of a cluster's gas primarily reflects the cluster's potential well depth; heating or cooling of the gas merely causes it to expand or contract in the potential well with only a modest change in temperature. The density of that gas depends on how much gravity can compress it in the cluster's potential well, and it is the specific entropy of the gas that determines its density at a given pressure. Thus, the observable X-ray properties of a relaxed cluster of galaxies depend almost entirely on two physical attributes: (1) the shape and depth of the cluster's dark matter halo and (2) the entropy distribution of the intracluster gas (e.g., Voit et al. 2002).

Intracluster entropy is also intimately related to the cooling and feedback processes that govern galaxy evolution and that may also play a role in limiting condensation in cluster cores. Theories and simulations of cluster formation that ignore these processes fail to reproduce the observable properties of present-day clusters. ty alone were responsible for shaping the appearances of s and groups, then we would expect their properties to be self-similar, with a luminosity-temperature relation like . Furthermore, we would expect groups and clusters similar surface brightness profiles, when scaled to the virial radius of the system. However, observations indicate that

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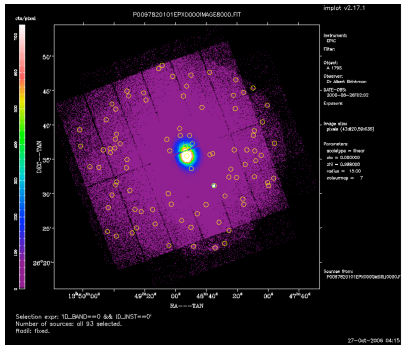
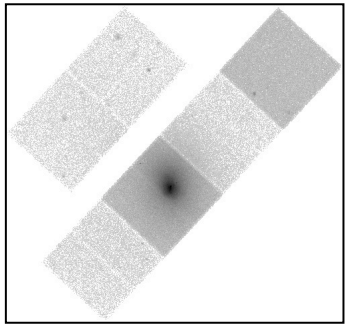
[2] NASA Goddard Space Flight Center, Code 660, Greenbelt, horner@milkyway.gsfc.nasa.gov.

text





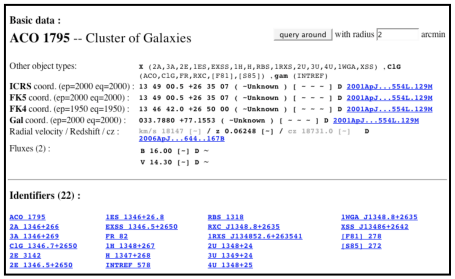
X-MM-Newton X-ray observation
Vilspa, Spain

Chandra X-ray observation
Cambridge, MA

A1795

Basic object information
Strasbourg, France

Hubble optical observation
Baltimore, MD



Basic data :

ACO 1795 -- Cluster of Galaxies

query around with radius 2 arcmin

Other object types: X (2A,3A,2E,1ES,EXSS,1H,H,RBS,1RXS,2U,3U,4U,1WGA,XSS) ,ClG (ACO,ClG,FR,RXC,[PS1],[SBS]) ,gam (INTREF)

ICRS coord. (ep=2000 eq=2000) : 13 49 00.5 +26 35 07 (~Unknown) [~ ~ ~] D 2001ApJ...554L.129M

FK5 coord. (ep=2000 eq=2000) : 13 49 00.5 +26 35 07 (~Unknown) [~ ~ ~] D 2001ApJ...554L.129M

FK4 coord. (ep=1950 eq=1950) : 13 46 42.0 +26 50 00 (~Unknown) [~ ~ ~] D 2001ApJ...554L.129M

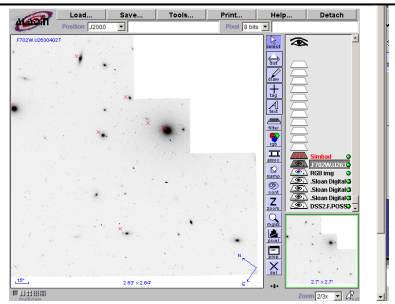
Gal coord. (ep=2000 eq=2000) : 033.7880 +77.1553 (~Unknown) [~ ~ ~] D 2001ApJ...554L.129M

Radial velocity / Redshift / cz : 2006ApJ...644..167B / z 0.06248 [~] / cz 18731.0 [~] D

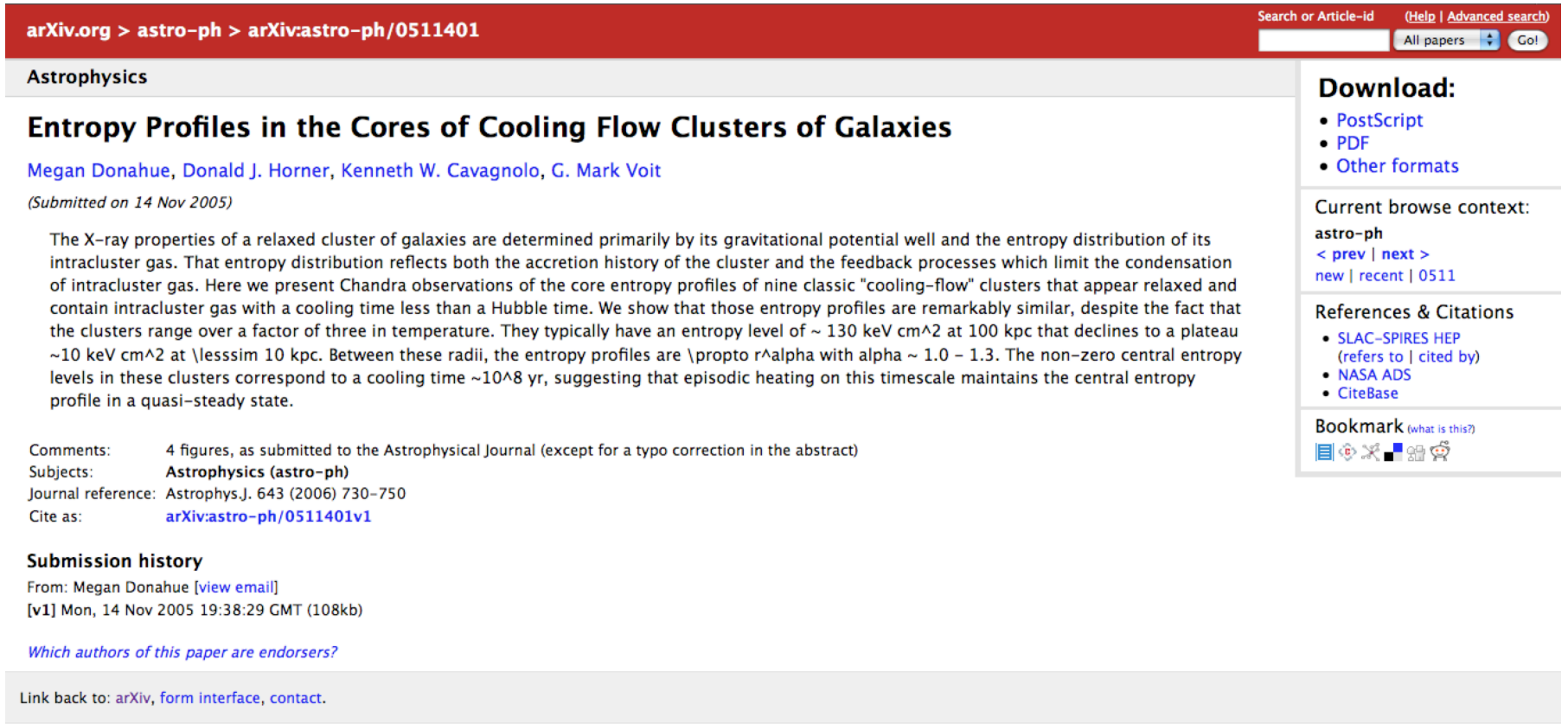
Fluxes (2) : B 16.00 [~] D ~ V 14.30 [~] D ~

Identifiers (22) :

ACO 1795 | 1ES 1346+26.8 | RBS 1318 | 1WGA J1348.8+2635
2A 1346+266 | RXSS 1346.5+2650 | RXC J1348.8+2635 | XSS J1348+2642
3A 1346+269 | FR 82 | 1RXS J134852.6+263541 | [PS1] 278
ClG 1346.7+2650 | 1H 1348+267 | 2U 1348+24 | [SBS] 272
2E 3142 | H 1347+268 | 3U 1349+24
2E 1346.5+2650 | INTREF 578 | 4U 1348+25



Aggregations in eScience



arXiv.org > astro-ph > arXiv:astro-ph/0511401

Search or Article-id (Help | Advanced search) All papers Go!

Astrophysics

Entropy Profiles in the Cores of Cooling Flow Clusters of Galaxies

Megan Donahue, Donald J. Horner, Kenneth W. Cavagnolo, G. Mark Voit

(Submitted on 14 Nov 2005)

The X-ray properties of a relaxed cluster of galaxies are determined primarily by its gravitational potential well and the entropy distribution of its intracluster gas. That entropy distribution reflects both the accretion history of the cluster and the feedback processes which limit the condensation of intracluster gas. Here we present Chandra observations of the core entropy profiles of nine classic "cooling-flow" clusters that appear relaxed and contain intracluster gas with a cooling time less than a Hubble time. We show that those entropy profiles are remarkably similar, despite the fact that the clusters range over a factor of three in temperature. They typically have an entropy level of ~ 130 keV cm^2 at 100 kpc that declines to a plateau ~10 keV cm^2 at \lesssim 10 kpc. Between these radii, the entropy profiles are \propto r^alpha with alpha ~ 1.0 - 1.3. The non-zero central entropy levels in these clusters correspond to a cooling time ~10^8 yr, suggesting that episodic heating on this timescale maintains the central entropy profile in a quasi-steady state.

Comments: 4 figures, as submitted to the Astrophysical Journal (except for a typo correction in the abstract)
Subjects: **Astrophysics (astro-ph)**
Journal reference: Astrophys.J. 643 (2006) 730-750
Cite as: **arXiv:astro-ph/0511401v1**

Submission history

From: Megan Donahue [view email]
[v1] Mon, 14 Nov 2005 19:38:29 GMT (108kb)

Which authors of this paper are endorsers?

Link back to: arXiv, form interface, contact.

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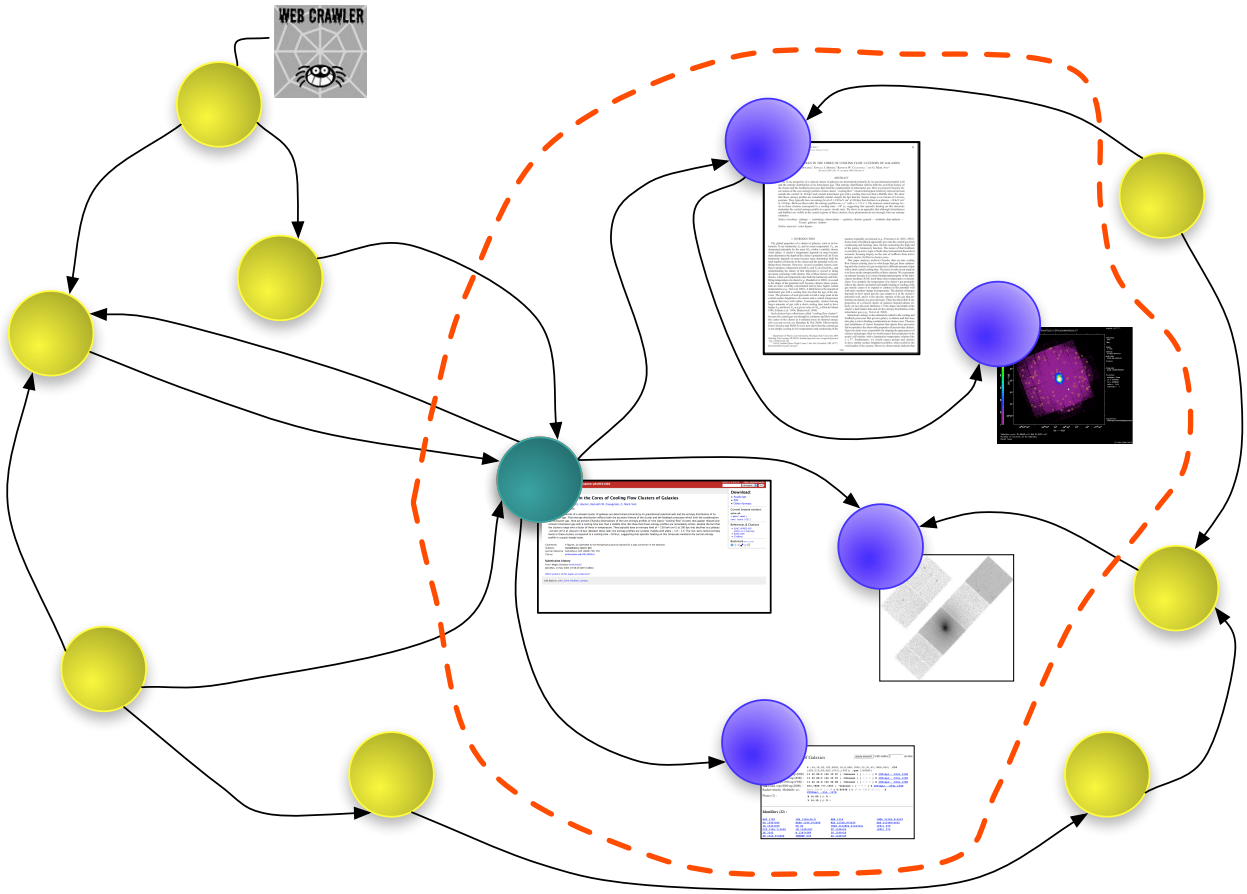
Current browse context:
astro-ph
< prev | next >
new | recent | 0511

References & Citations

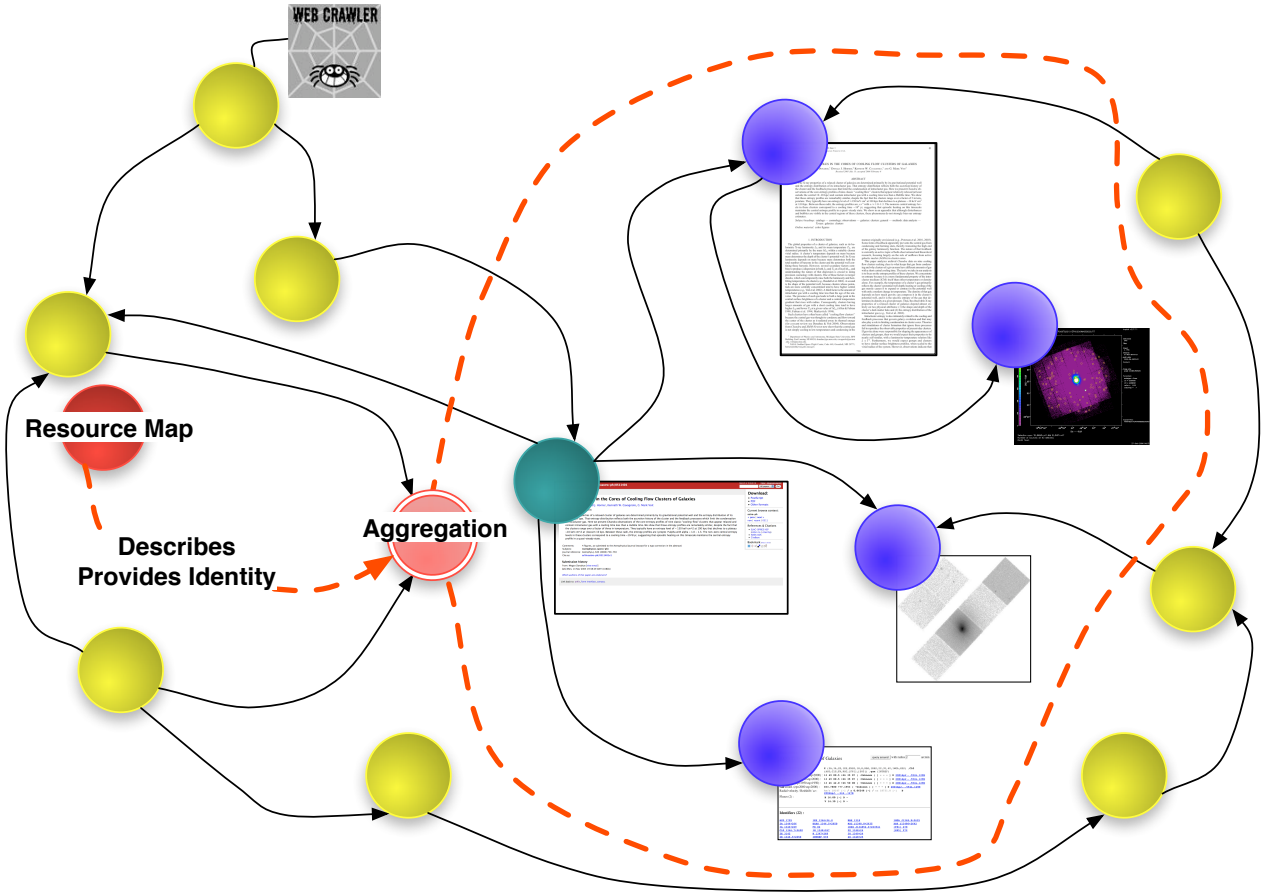
- SLAC-SPIRES HEP (refers to | cited by)
- NASA ADS
- CiteBase

Bookmark (what is this?)

Pre-ORE situation



ORE Approach



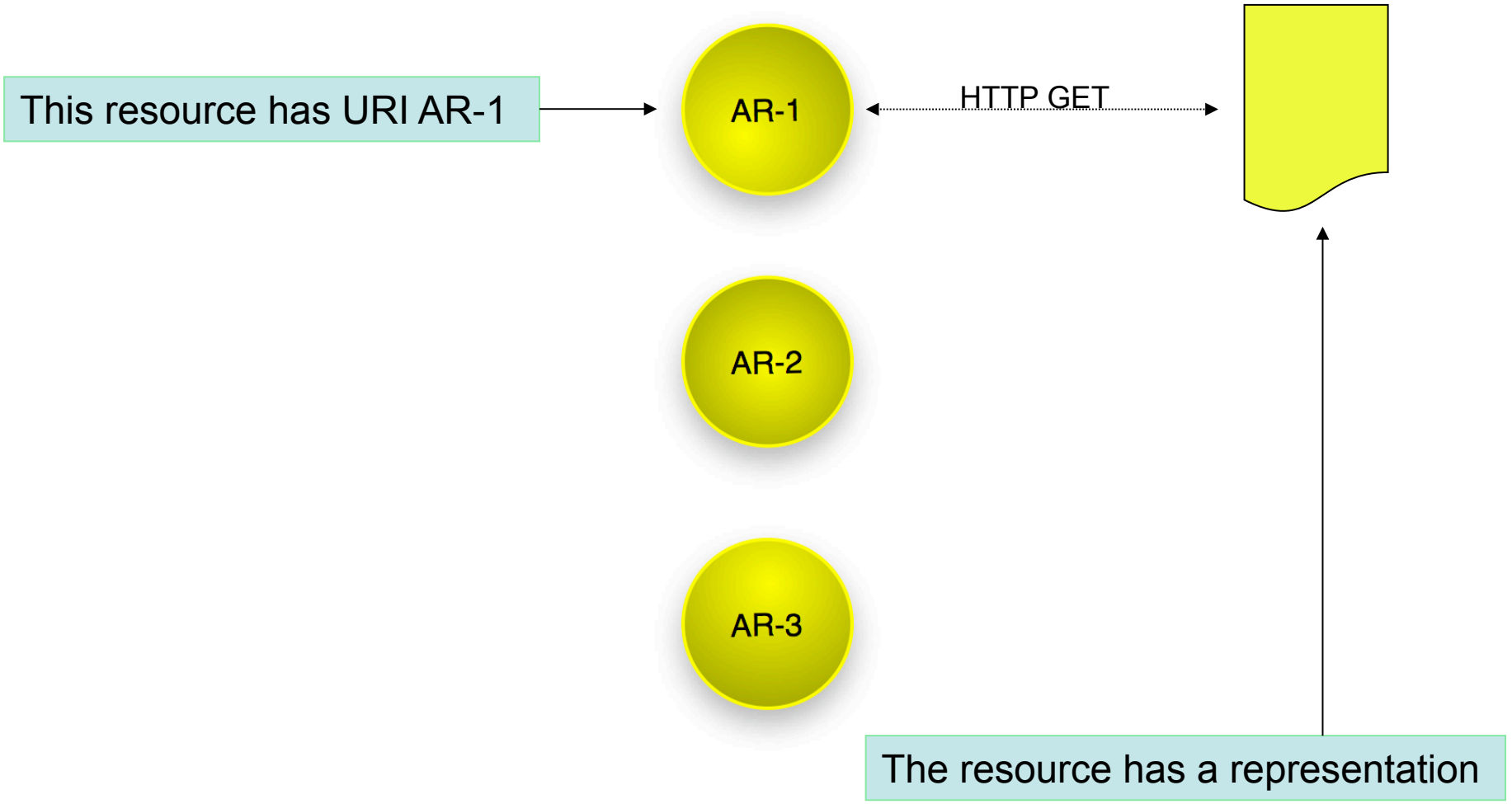
OAI Object Reuse and Exchange: The Basics

Aggregation
Aggregated Resources
`ore:aggregates`

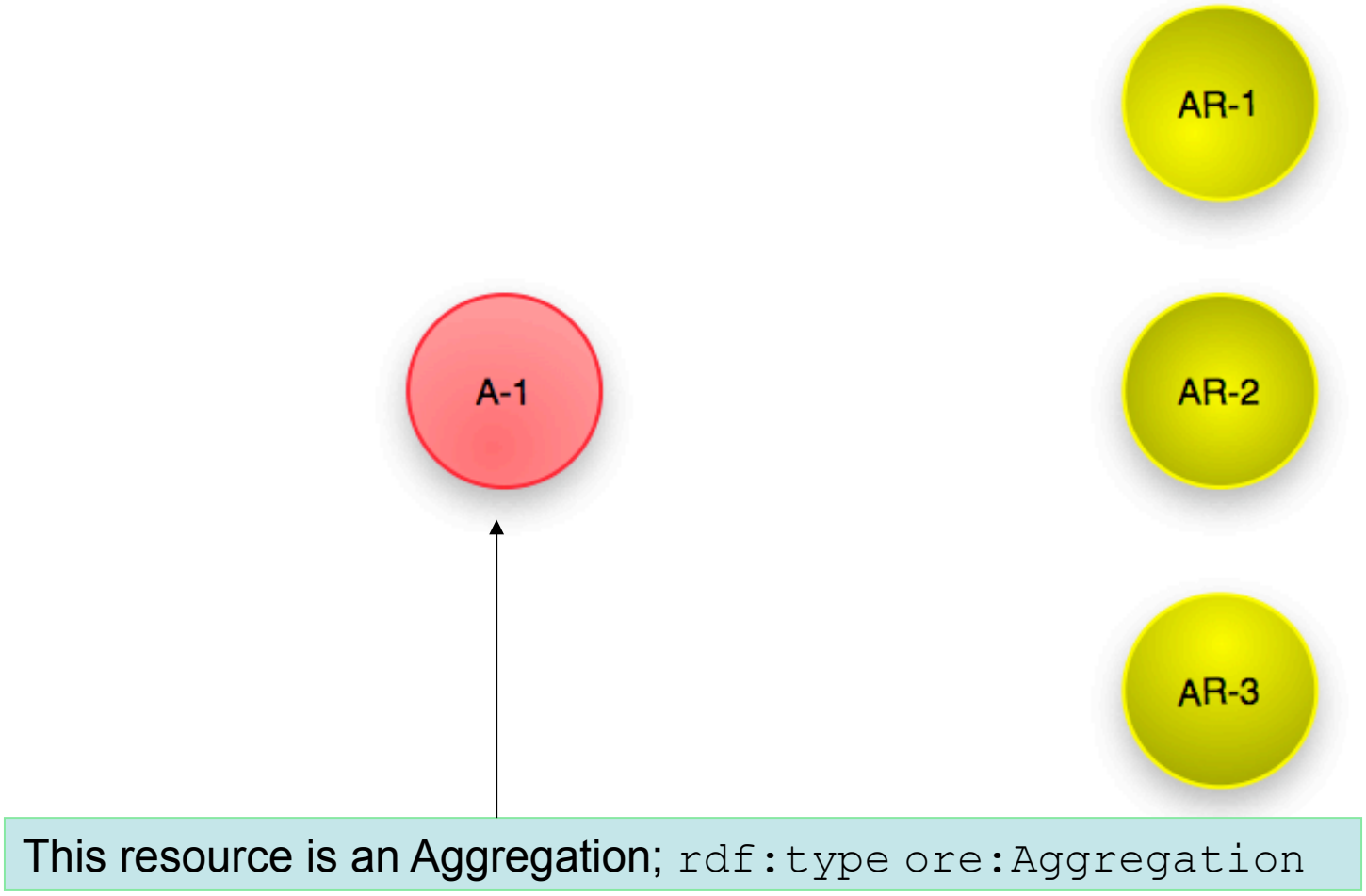
Resource Map
`ore:describes`

Relationships and Types

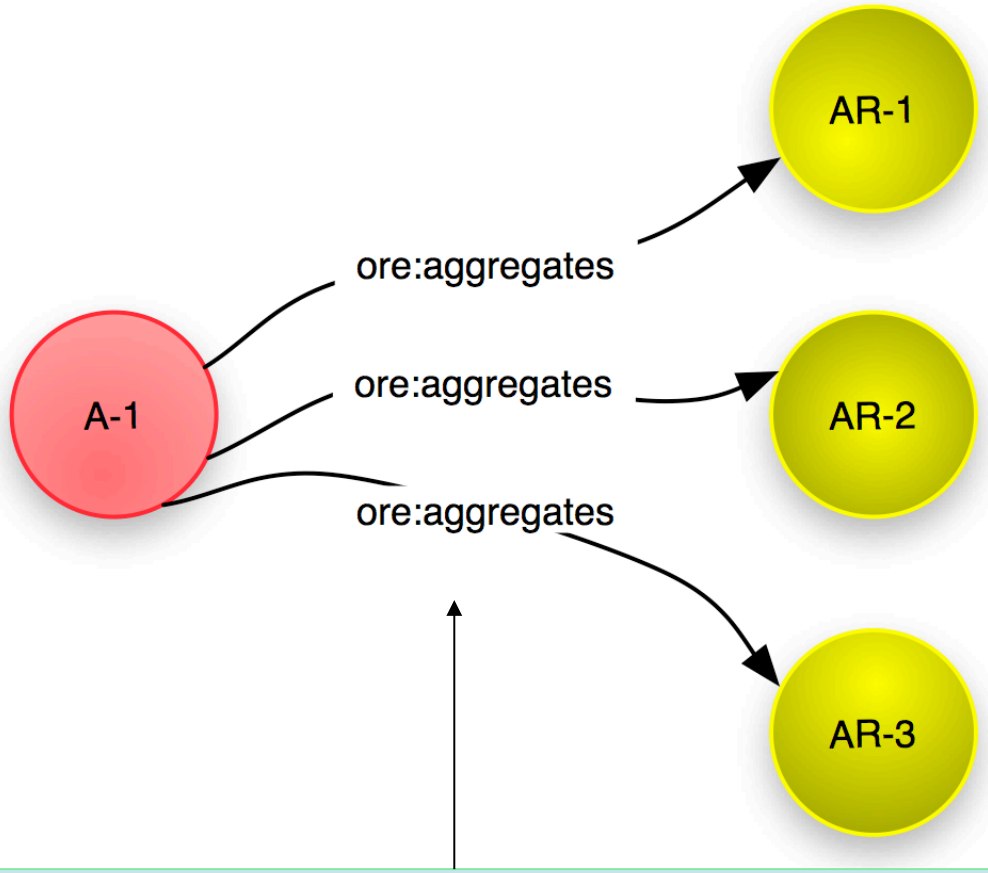
It starts with some resources that *belong together*



Introduce the Aggregation (mint HTTP URI A-1)

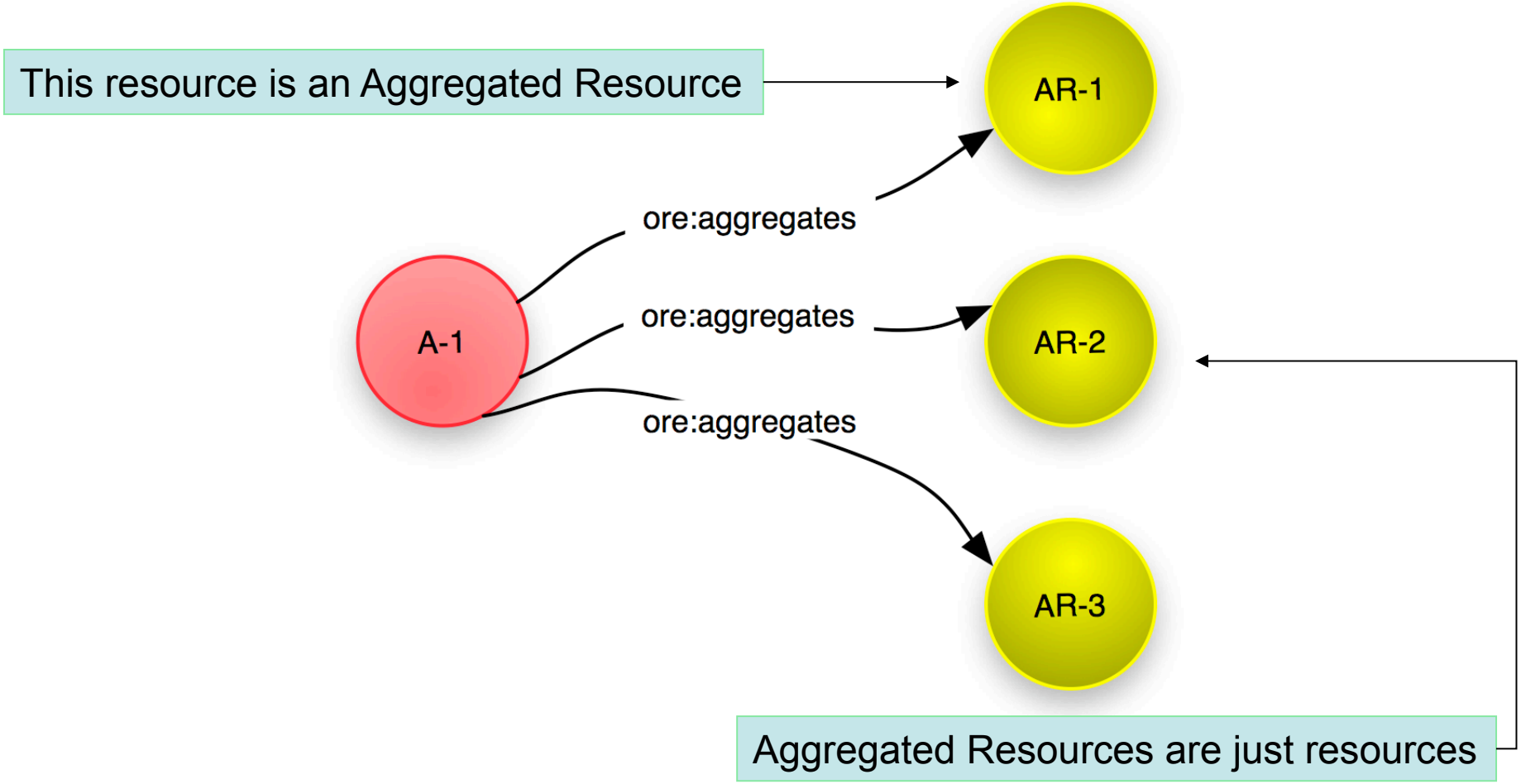


Express the `ore:aggregates` relationship

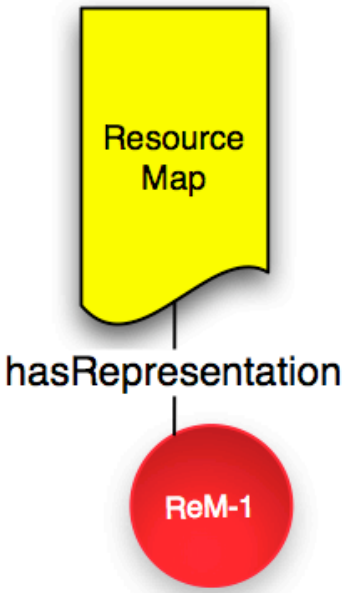


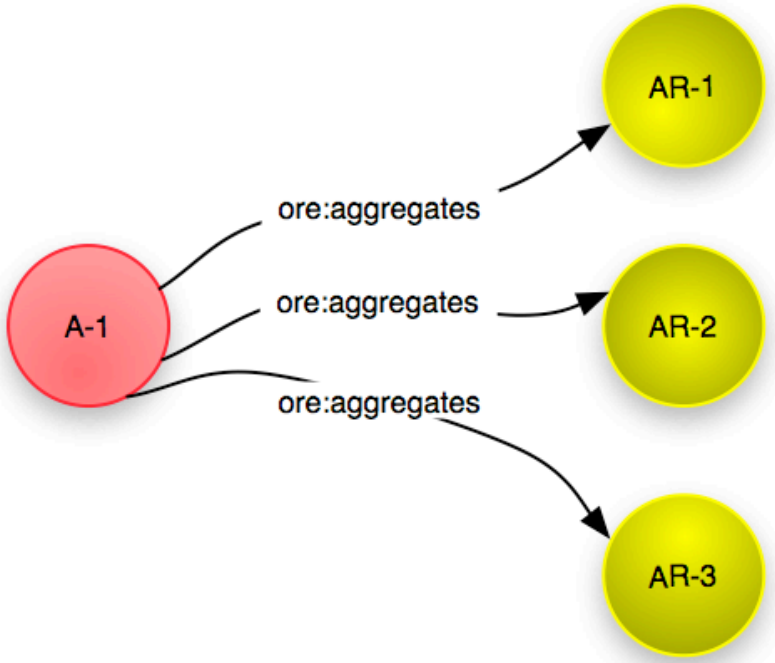
Subproperty of `dcterms:hasPart`. The inverse is `ore:isAggregatedBy`

The `ore:aggregates` relationship

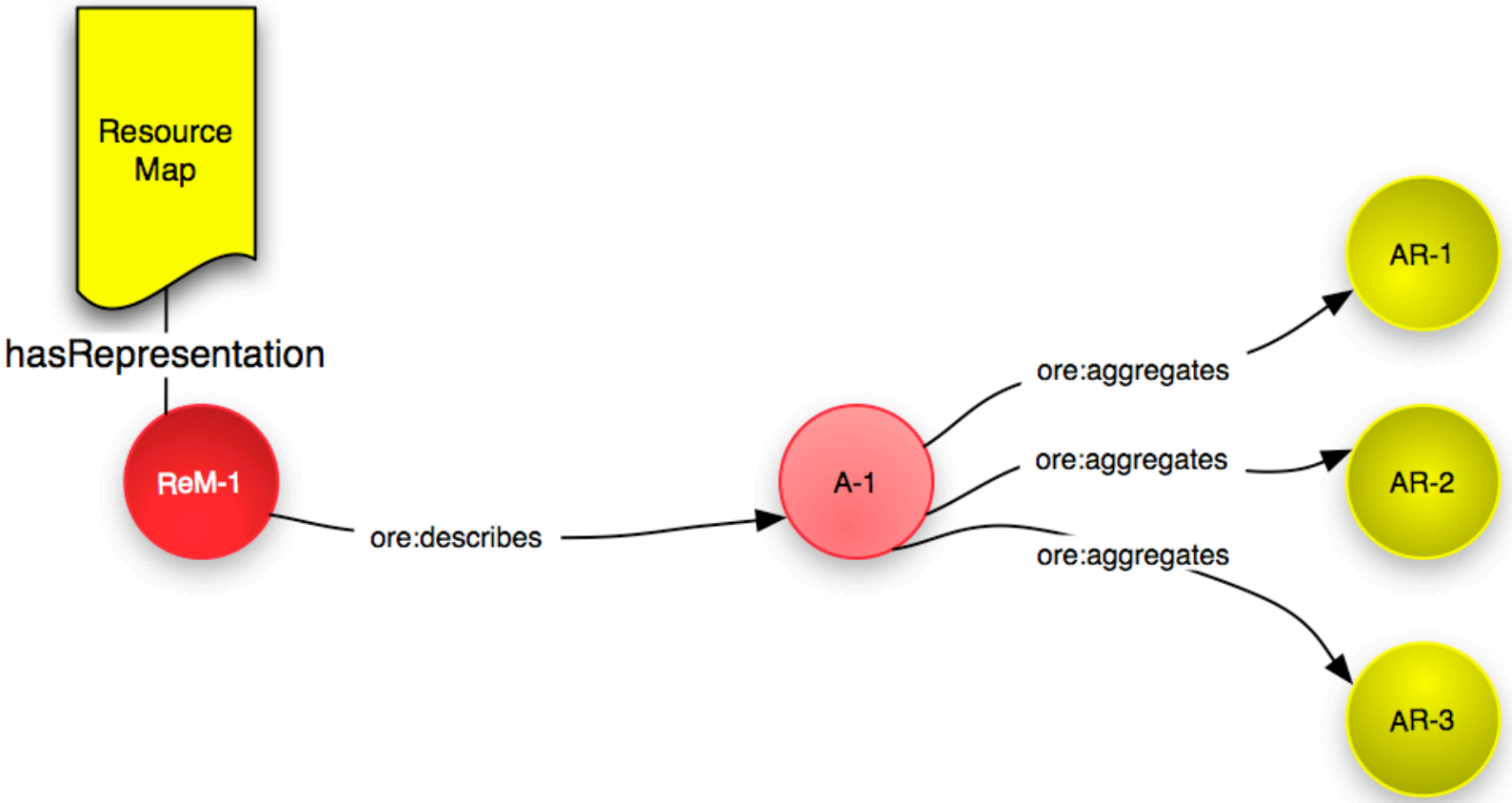


Introduce the Resource Map (mint HTTP URI ReM-1)

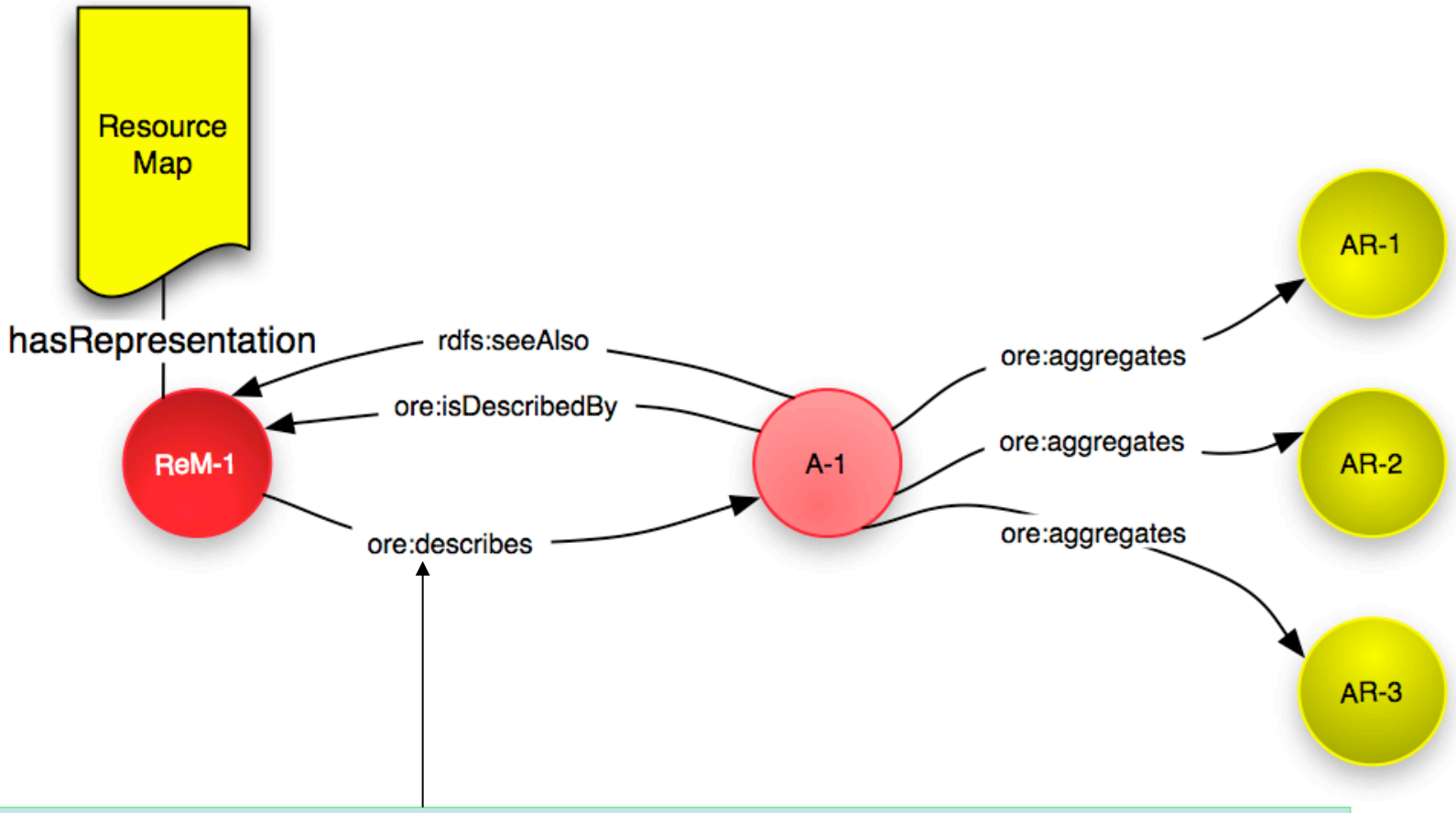




Express the `ore:describes` relationship

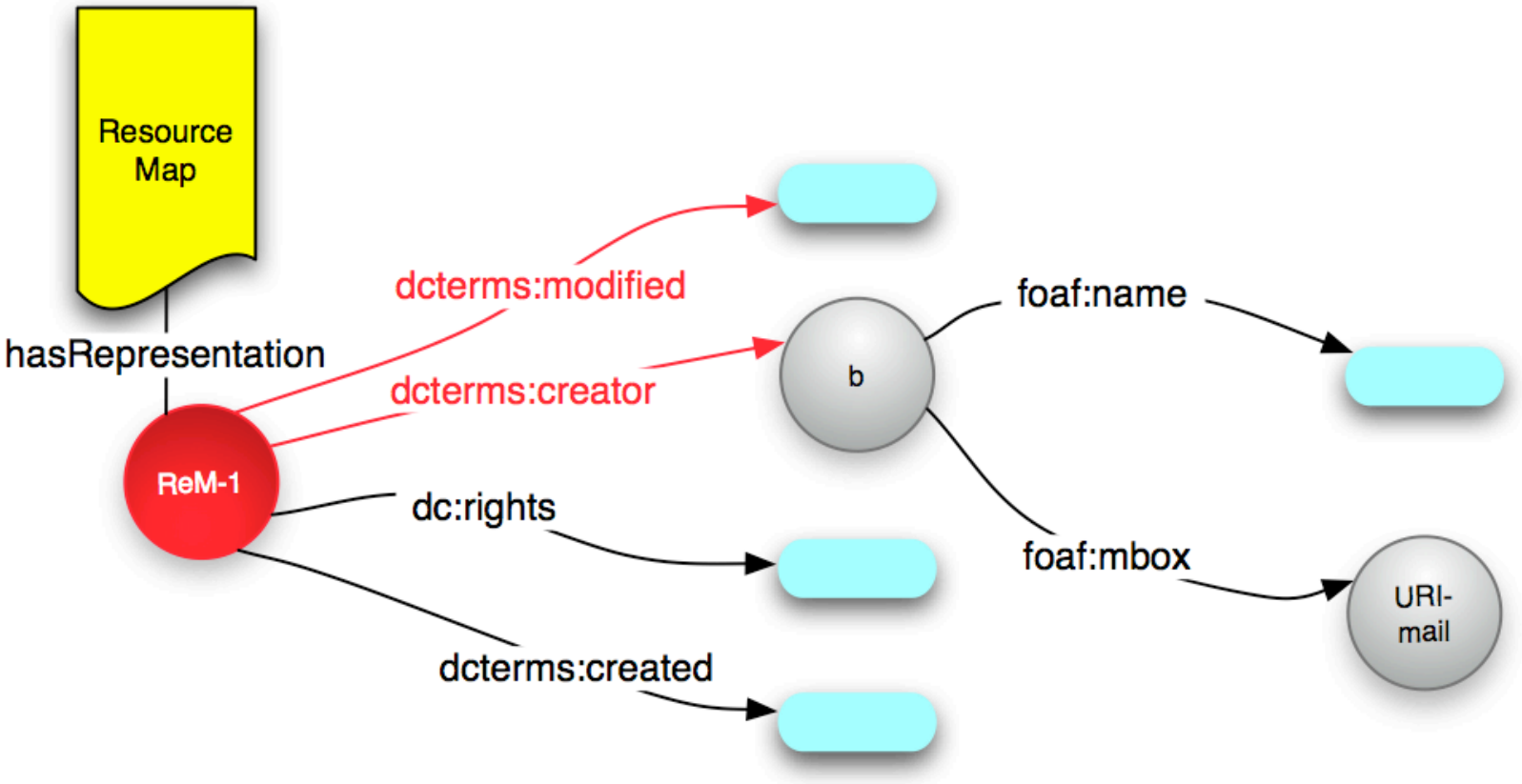


The `ore:isDescribedBy` relationship



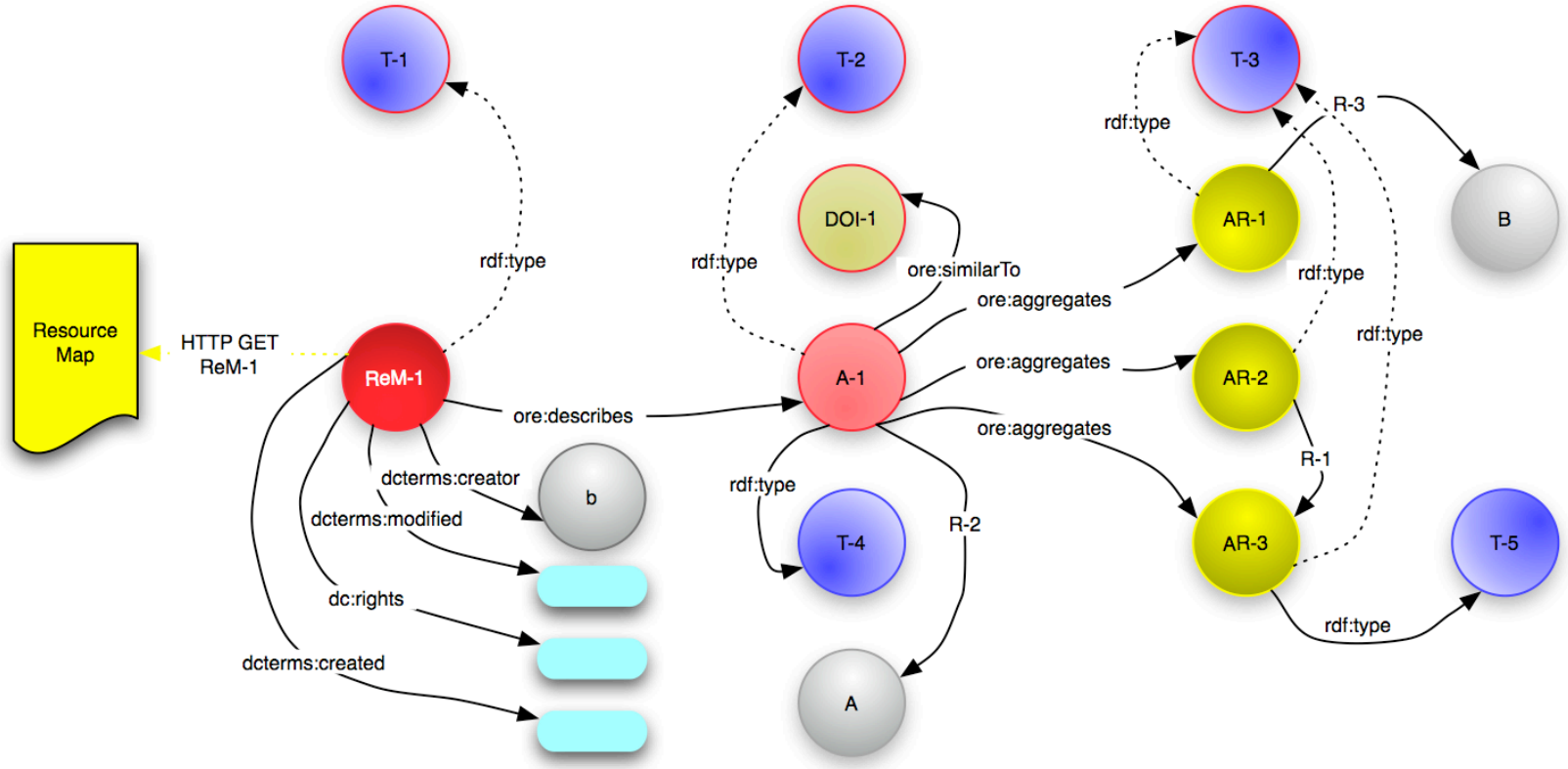
The inverse is `ore:isDescribedBy`; subproperty of `rdfs:seeAlso`

Express metadata about the Resource Map



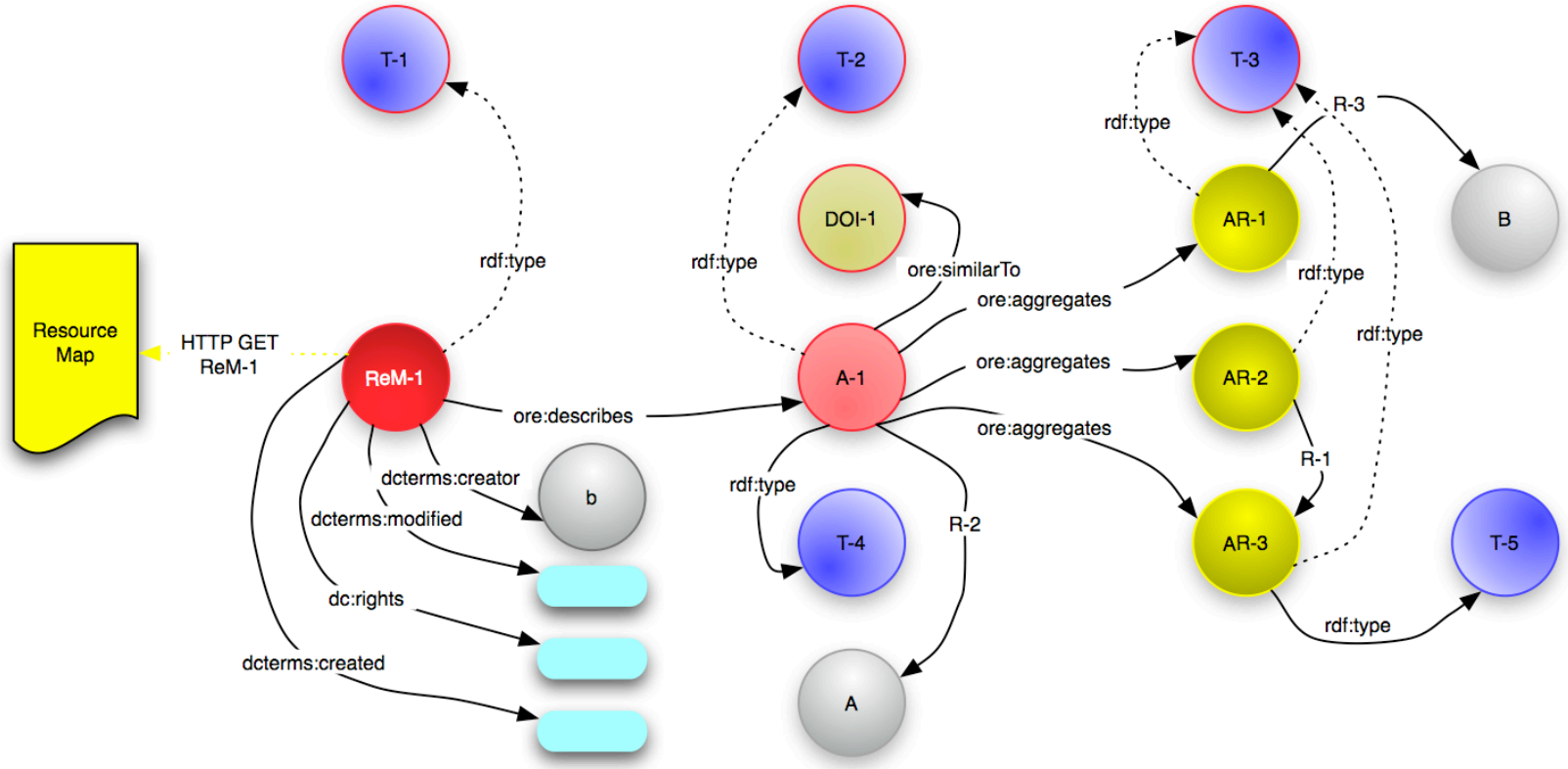
This corresponds to **metadata** from the Linked Data recommendations

A Resource Map can describe a lot …



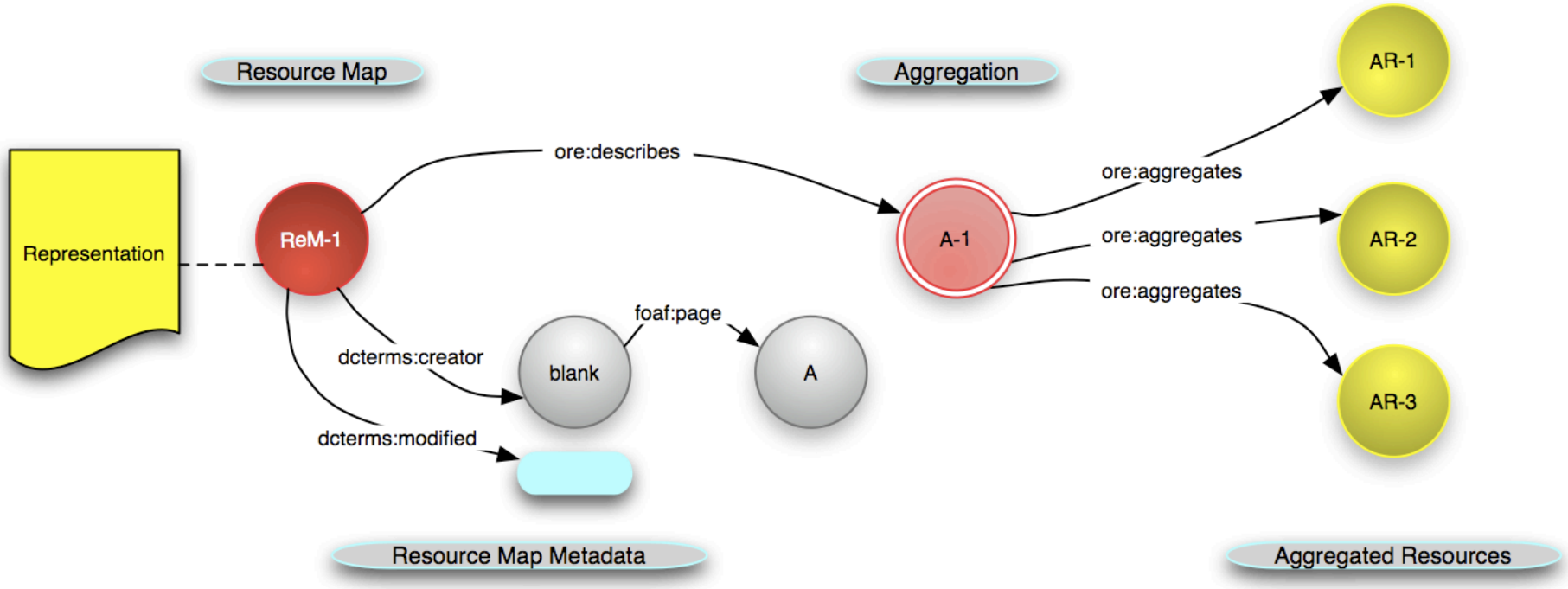
This corresponds to the **description**, **related descriptions**, **backlinks**, **metadata** from the Linked Data recommendations

A Resource Map can describe a lot …



The graph expressed by the Resource Map must be **connected**

But minimally it describes this …



This corresponds to the **description** (minimal), and **metadata** from the Linked Data recommendations

OAI Object Reuse and Exchange: Details in slides 40-63

Authoritative Resource Maps

Expressing non-protocol-based URIs

`ore:similarTo`

Aggregated Resource is itself an Aggregation

`ore:isDescribedBy`

Proxy: Aggregated Resource in Context of an Aggregation

`ore:isProxyFor`

`ore:isProxyIn`

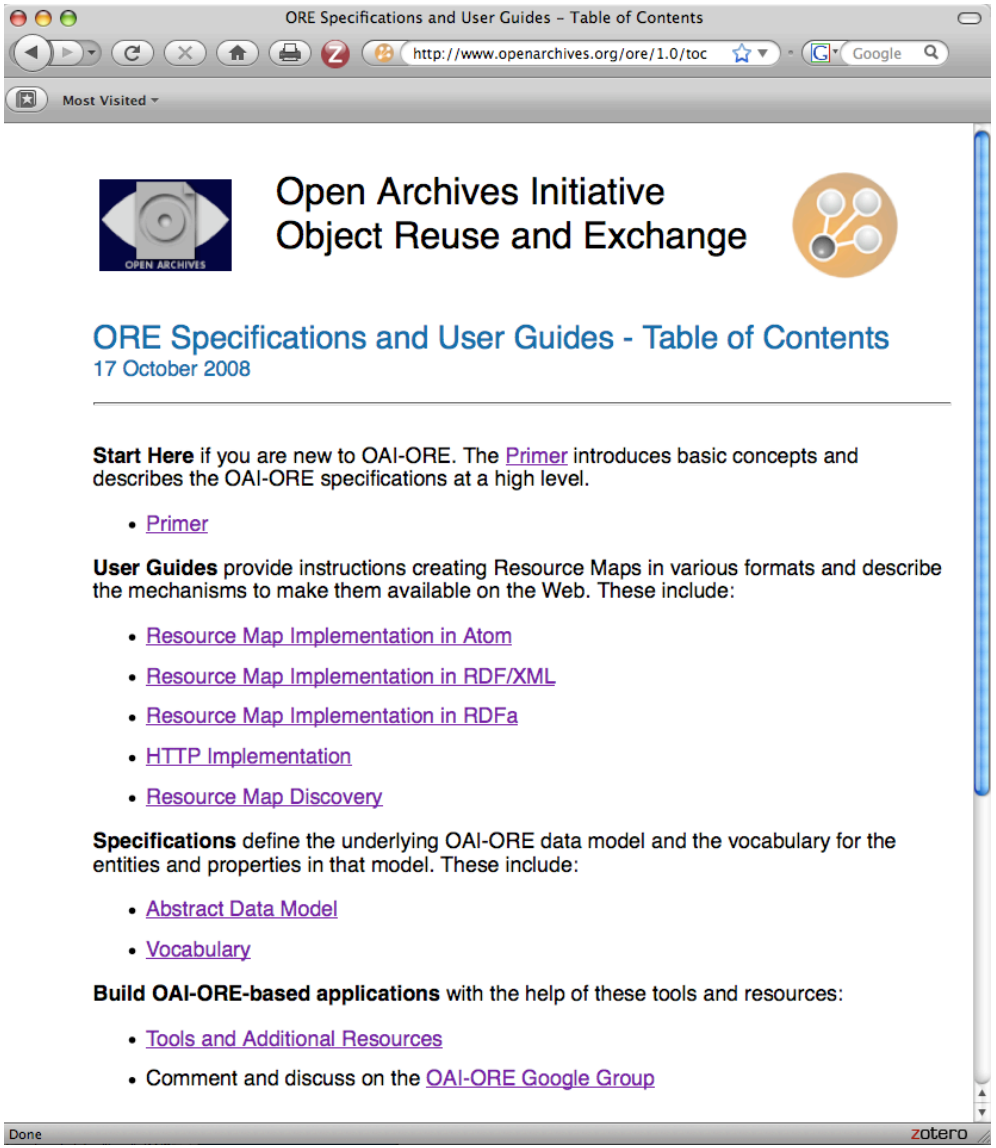
Lineage of an Aggregated Resource

`ore:lineage`

- Version 1.0 released October 17th 2008

- **ORE Primer**
- Atom Resource Maps
- RDF/XML Resource Maps
- RDFa Resource Maps
- HTTP implementation
- Discovery of Resource Maps
- Data Model
- Vocabulary

- Tools and Resources
- OAI-ORE Google Group



http://www.openarchives.org/ore/toc

Several interesting experiments based on ORE

- Digital preservation of aggregations:
  - http://www.ctwatch.org/quarterly/multimedia/11/ORE_prototype-demo/
- Social curation of aggregations:
  - http://african.lanl.gov/preserve/
- Exchange of compound objects between heterogeneous repository architectures:
  - http://journal.code4lib.org/articles/1062
  - http://blip.tv/file/866653
- Desktop-based creation of rich aggregations:
  - http://www.itee.uq.edu.au/~eresearch/papers/2007/IDCC07.pdf
  - http://maenad.itee.uq.edu.au/lore/

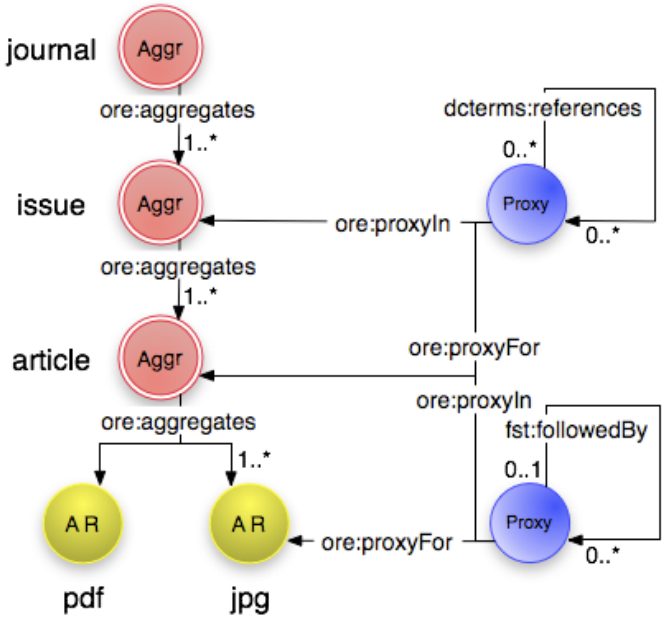
Early signs of adoption (1)

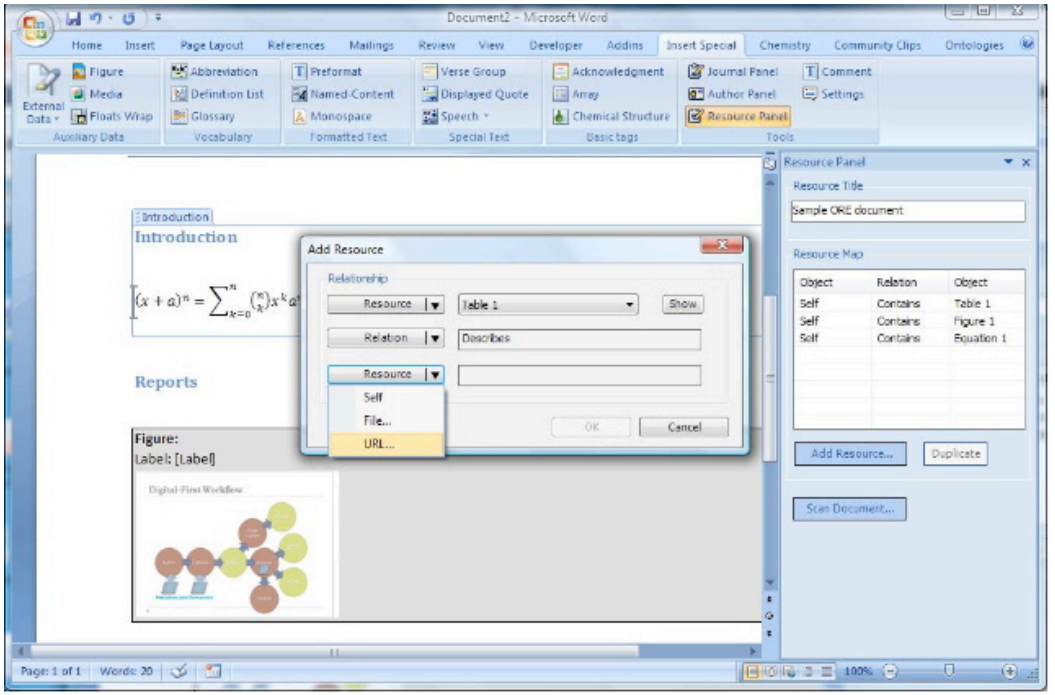
- ORE model is explored/recommended as the core model to deal with multi-resource scholarly and cultural heritage assets in various high-visibility projects:
  - OREchem
  - NSF DataNet
  - EU funded DRIVER 2, Europeana, EDLnet
    - http://driver2.dans.knaw.nl/demonstrator/html

- Major institutional repositories (Fedora, DSpace, ePrints) implementing ORE. Oxford Universities' Fedora:
  - HTML splash page: http://ora.ouls.ox.ac.uk/objects/uuid%3A12790621-14d6-41f1-8df3-0f944cf333e6
  - HTML splash page has <link rel="resourcemap" …> to Resource Map: http://ora.ouls.ox.ac.uk/objects/uuid:12790621-14d6-41f1-8df3-0f944cf333e6/aggregation.xml


Early signs of adoption (2)

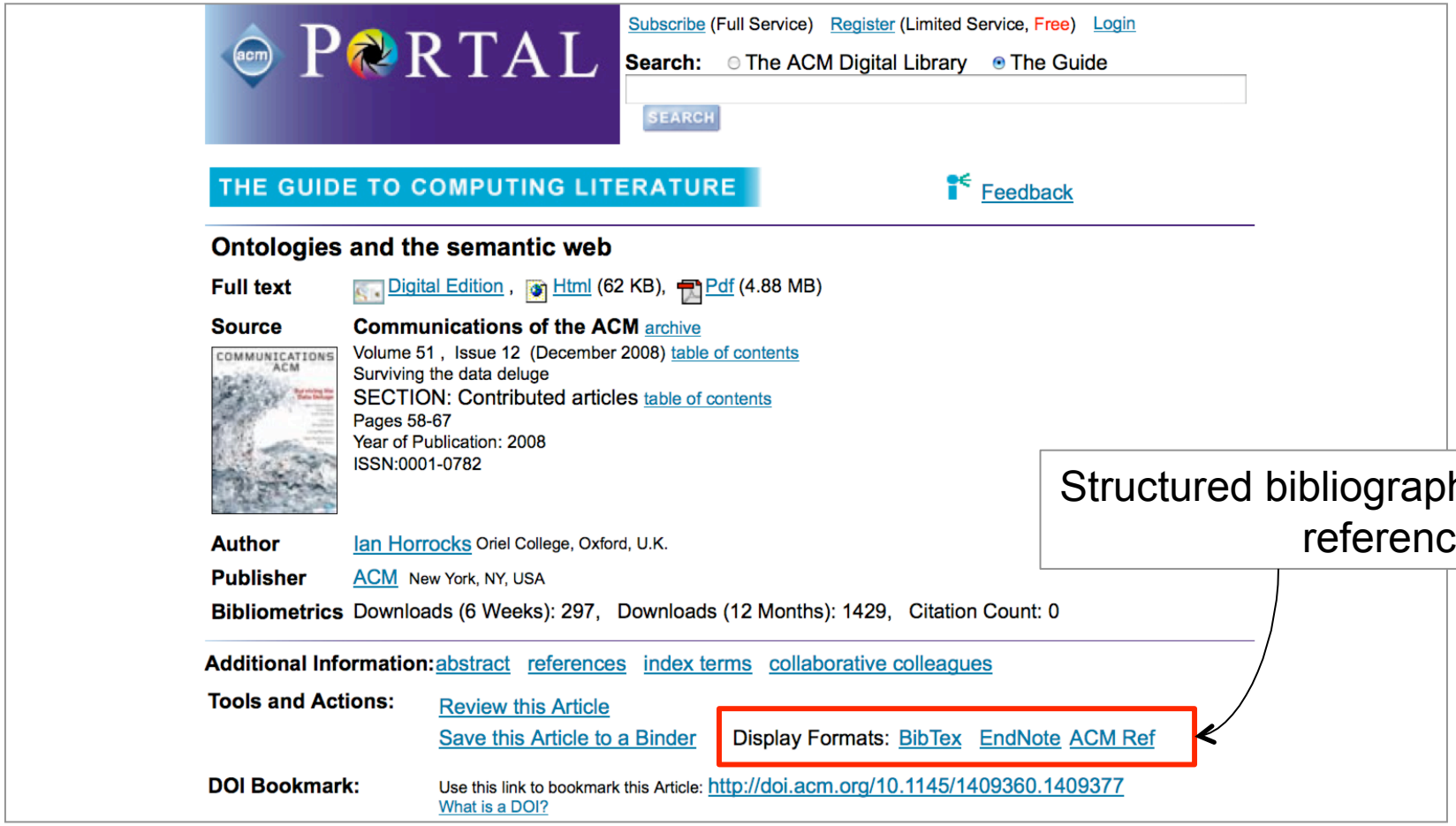
- JSTOR to bring Resource Map for its entire journal collection in production.





- Microsoft is developing technology that leverages ORE:
  - ORE Word plug-in
  - Research Output Repository Platform
    - http://research.microsoft.com/en-us/projects/zentity/

Demo: Writing papers (citing) leveraging ORE



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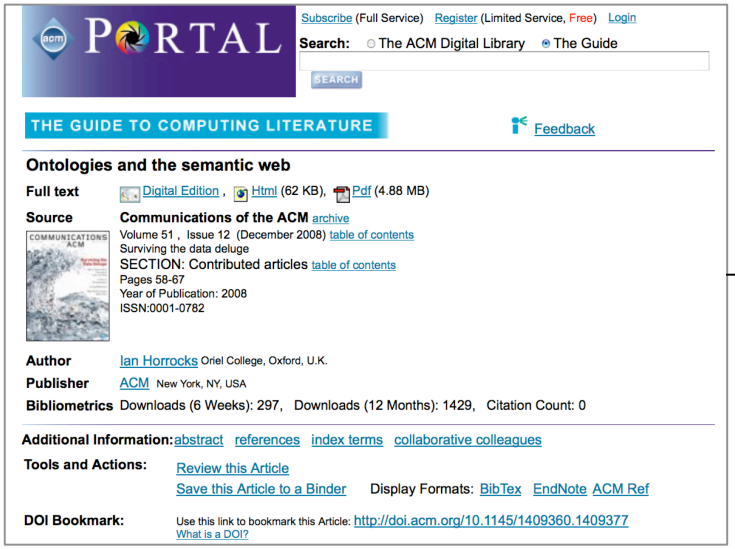
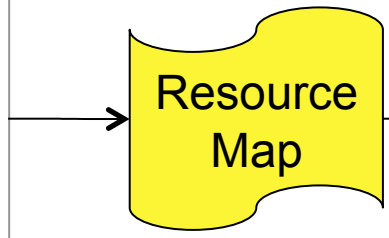
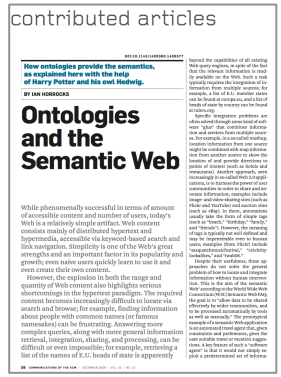




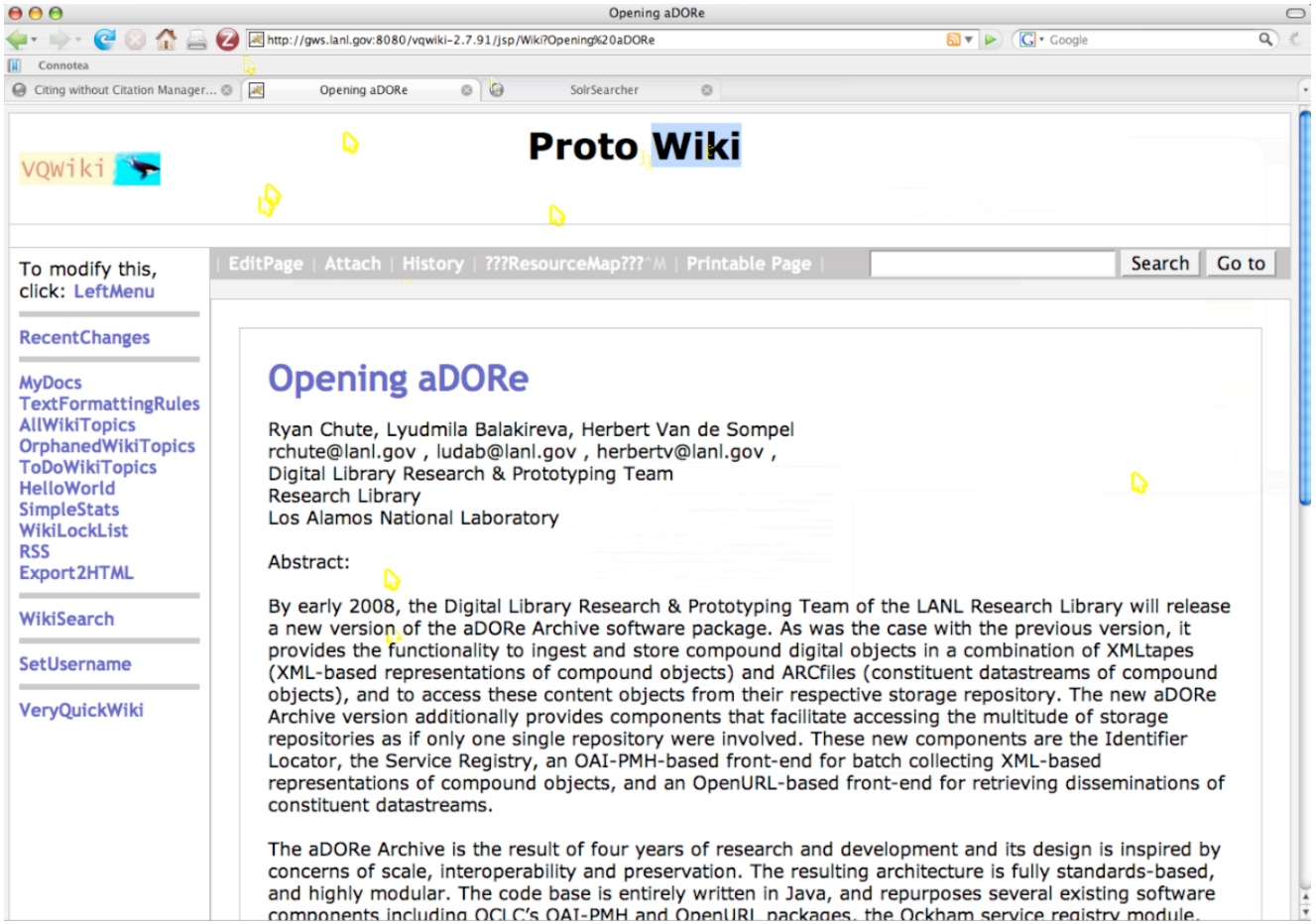


Typed as bibliographic description
Indication of bibliographic format

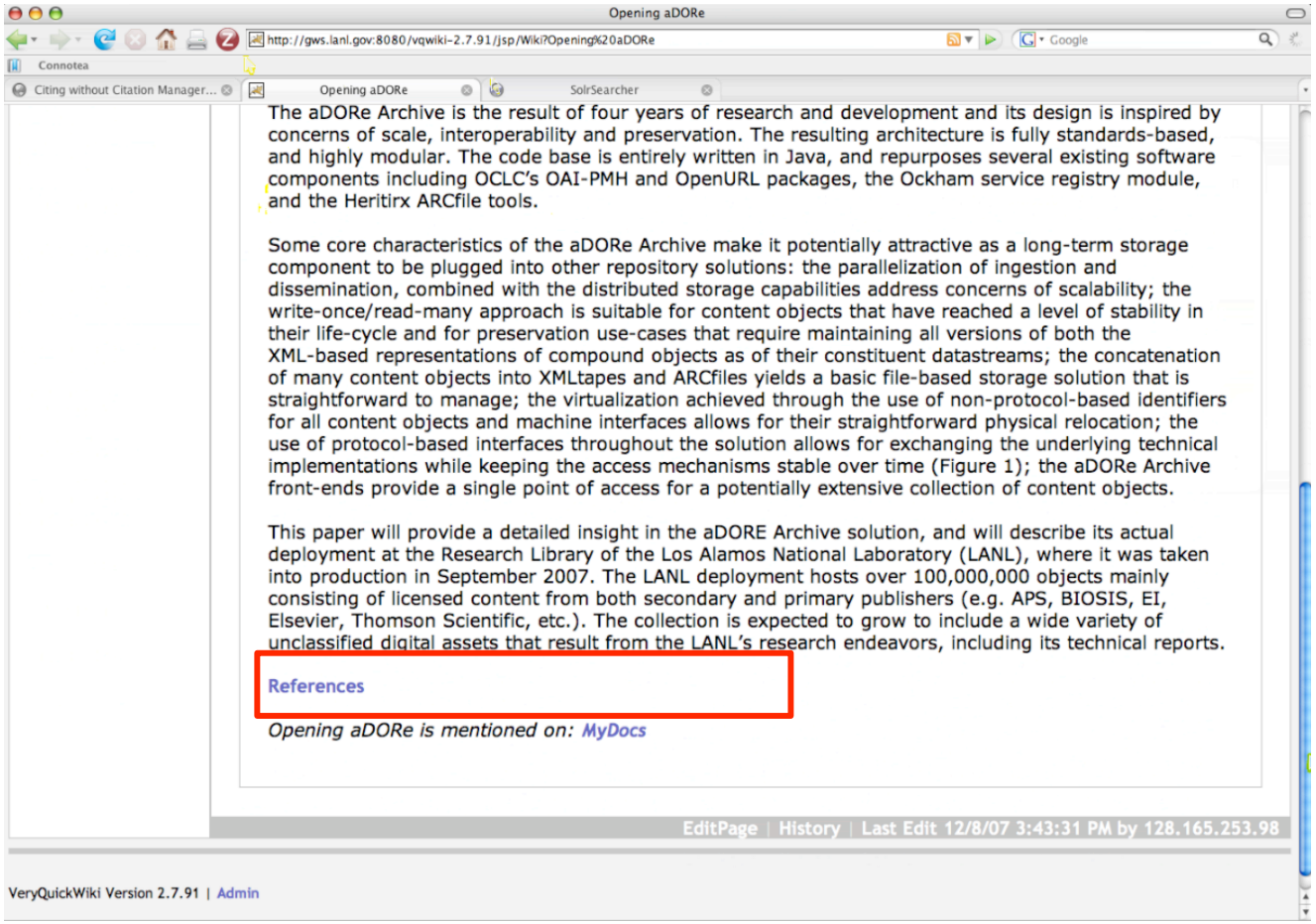
Experiment conducted by LANL Digital Library Research & Prototyping Team

Movie (no vox) at http://public.lanl.gov/herbertv/images/cite_no_manager.mov

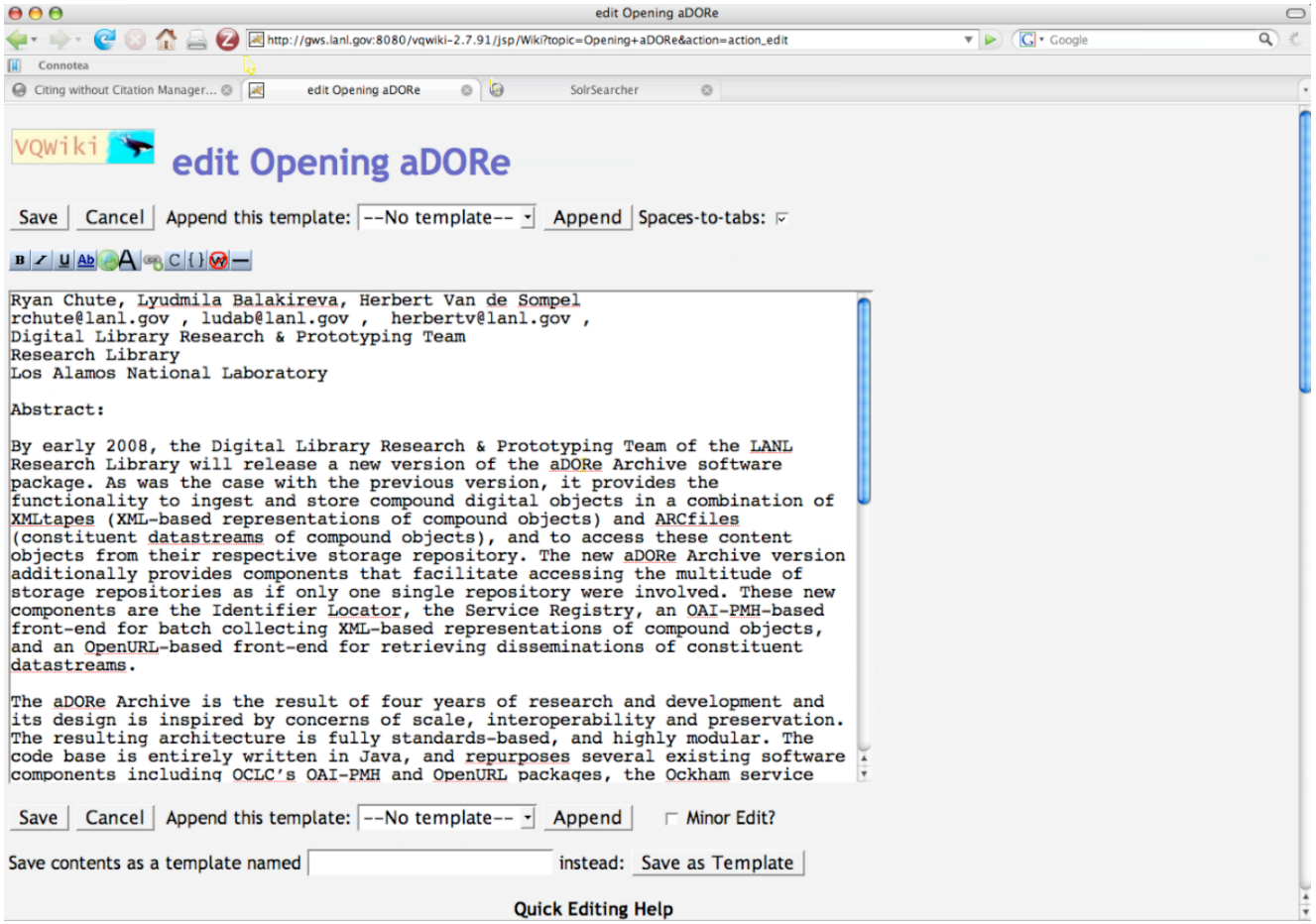
Web-based authoring environment



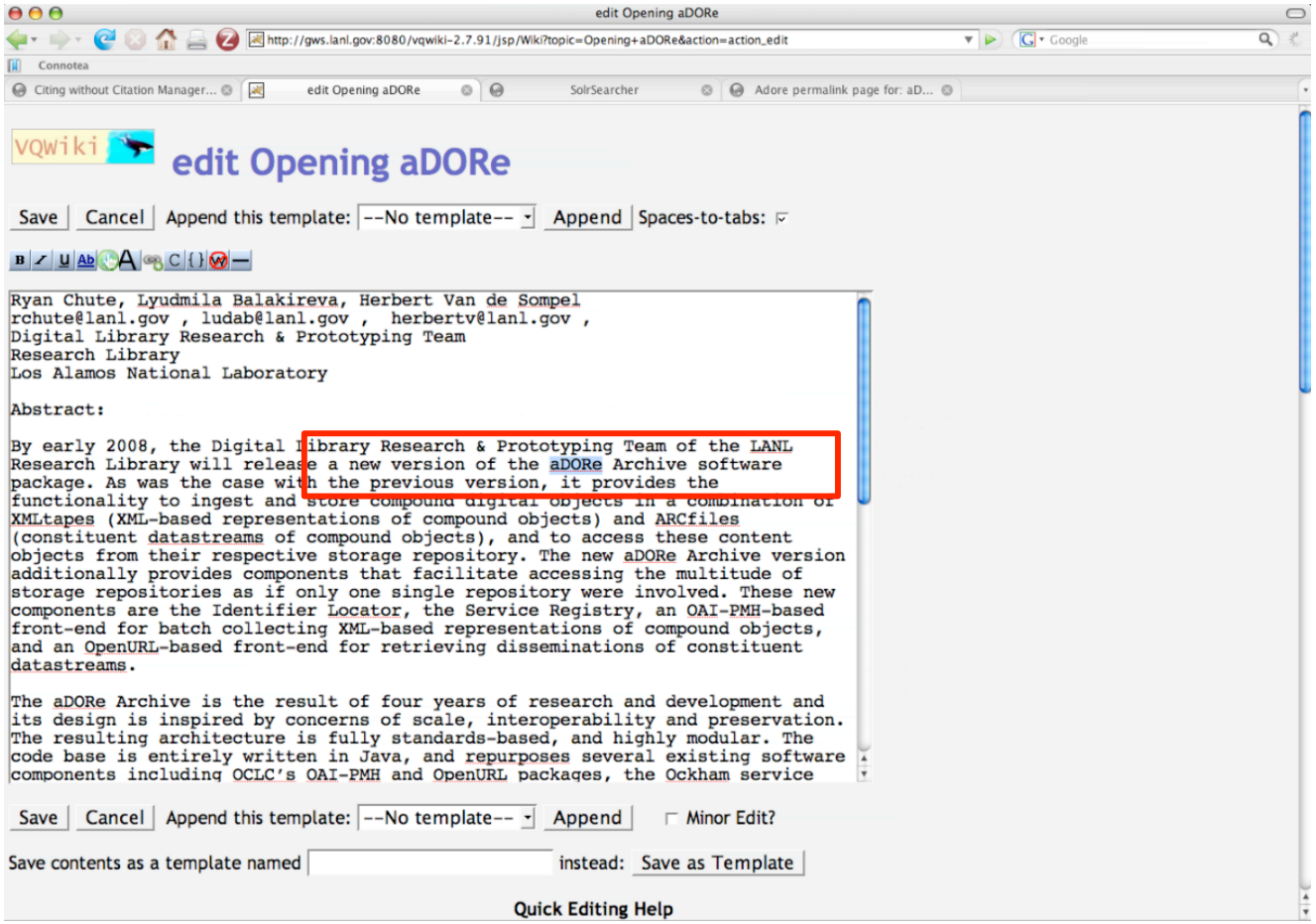
Empty *References* section



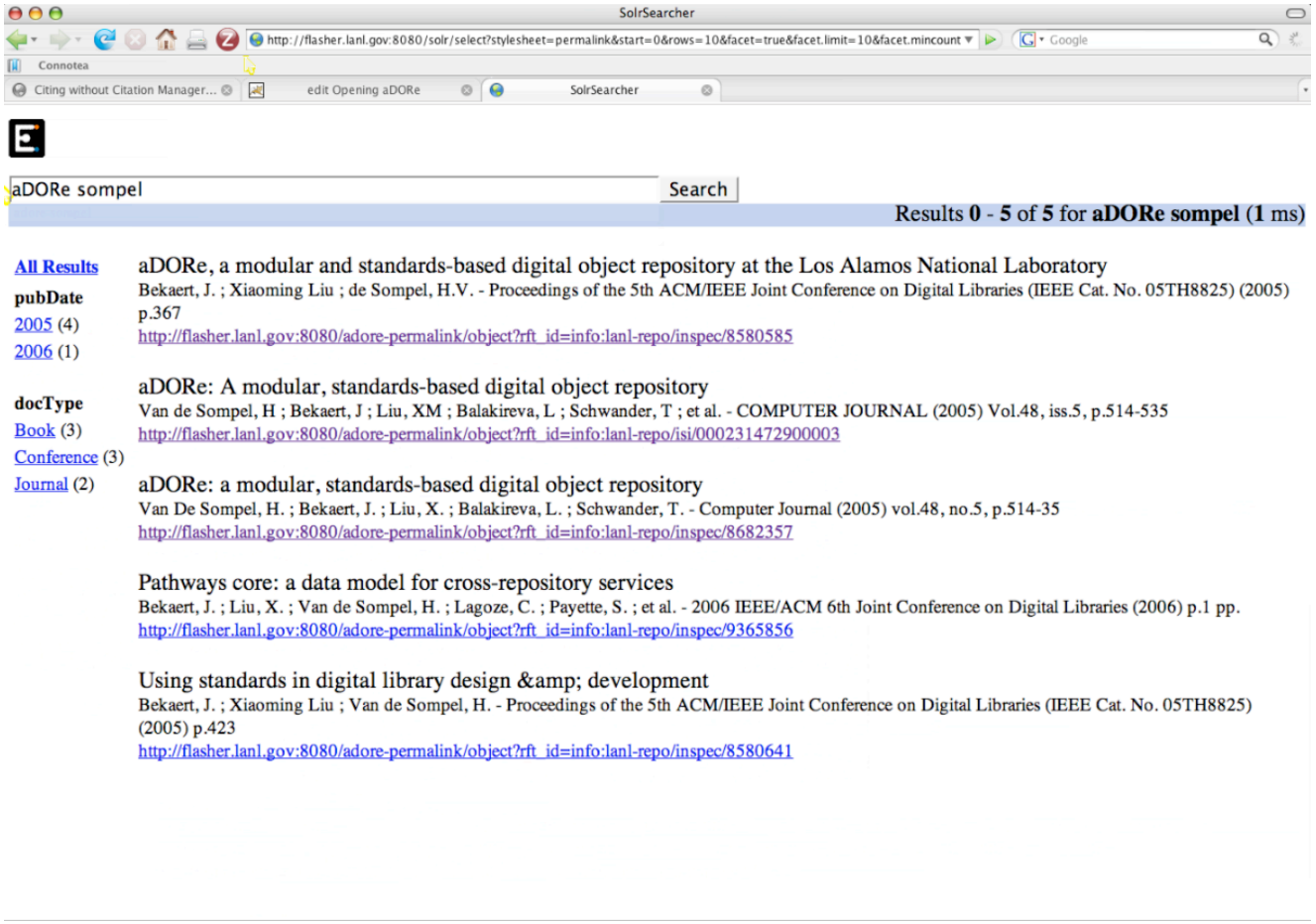
Start editing



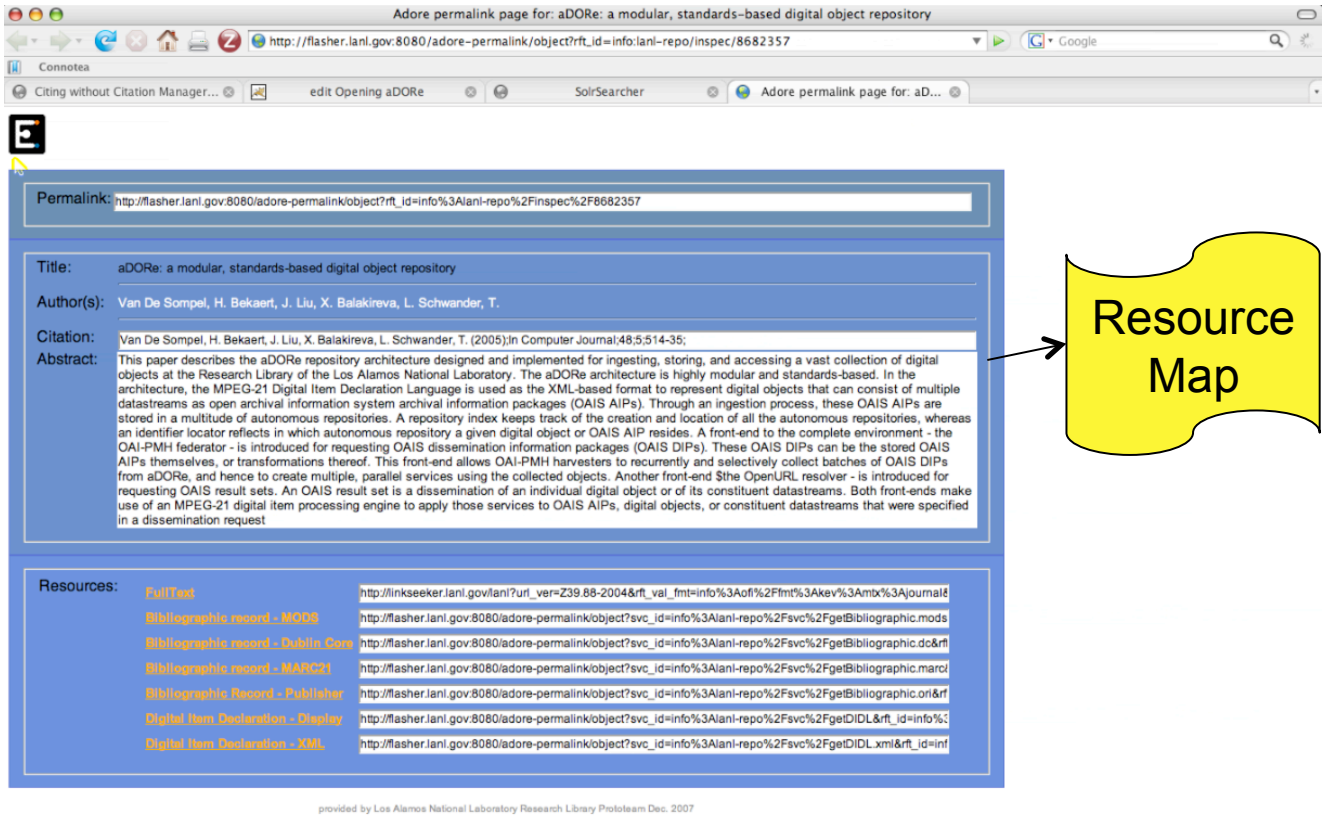
Select area where citation is needed



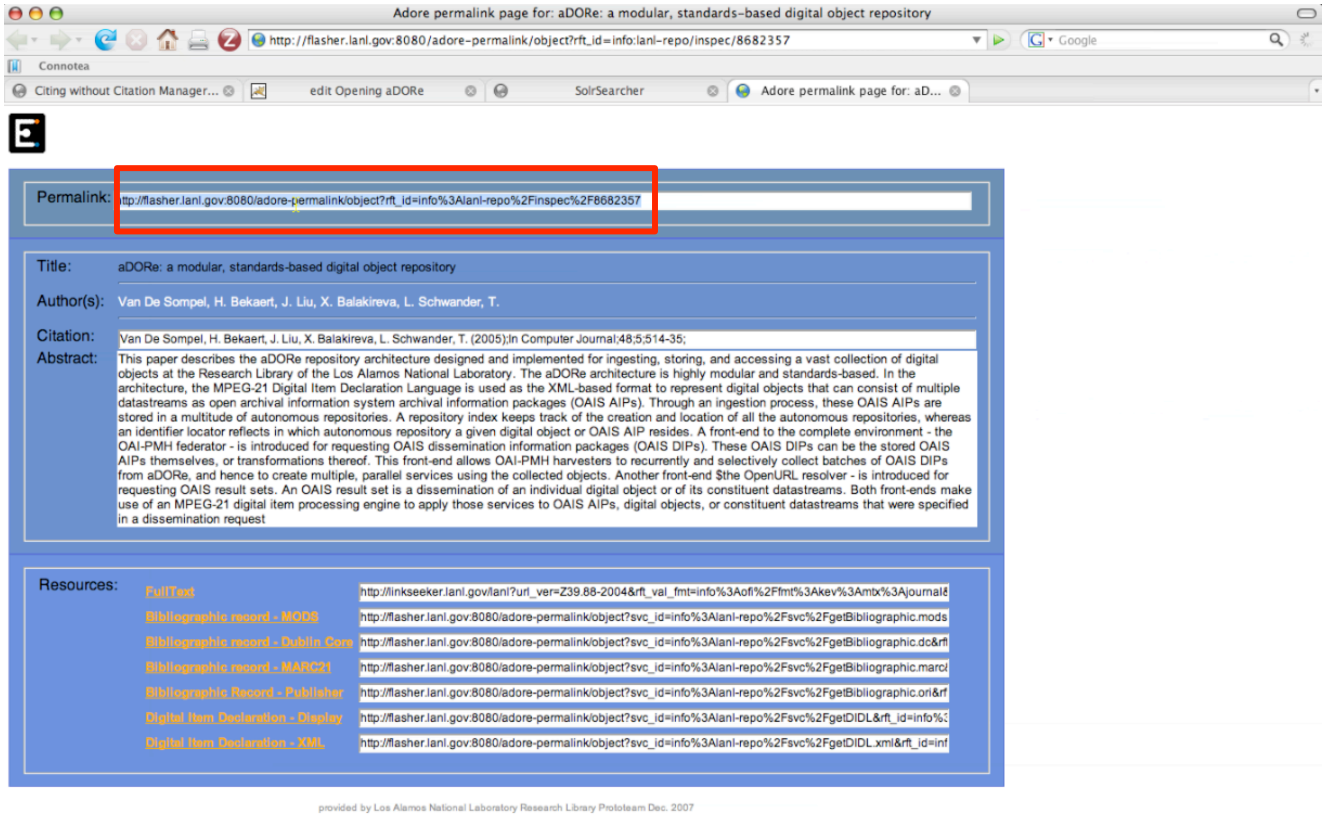
Use search engine to find to-be-cited paper



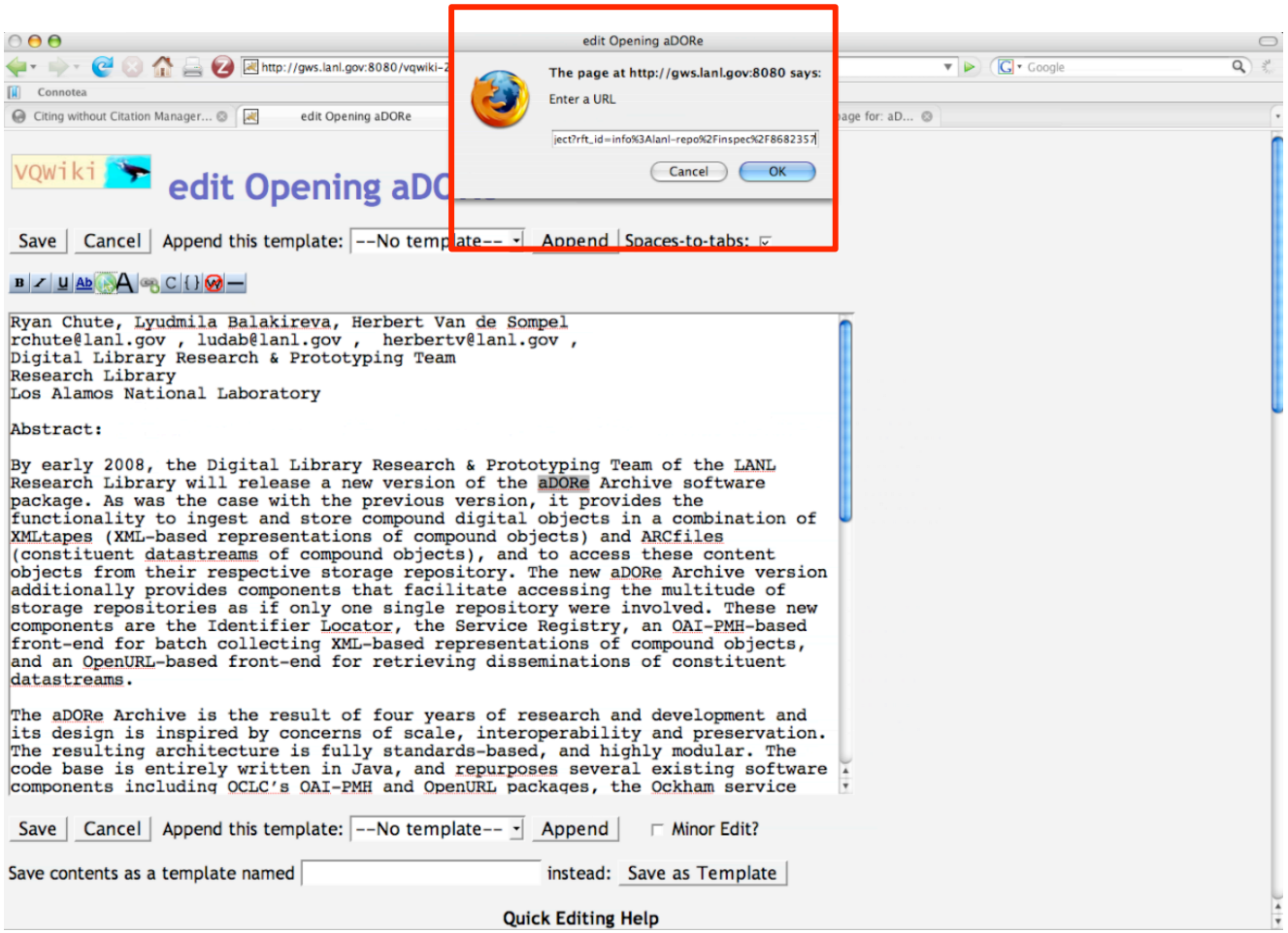
Got it. Remember Splash Page points at Resource Map



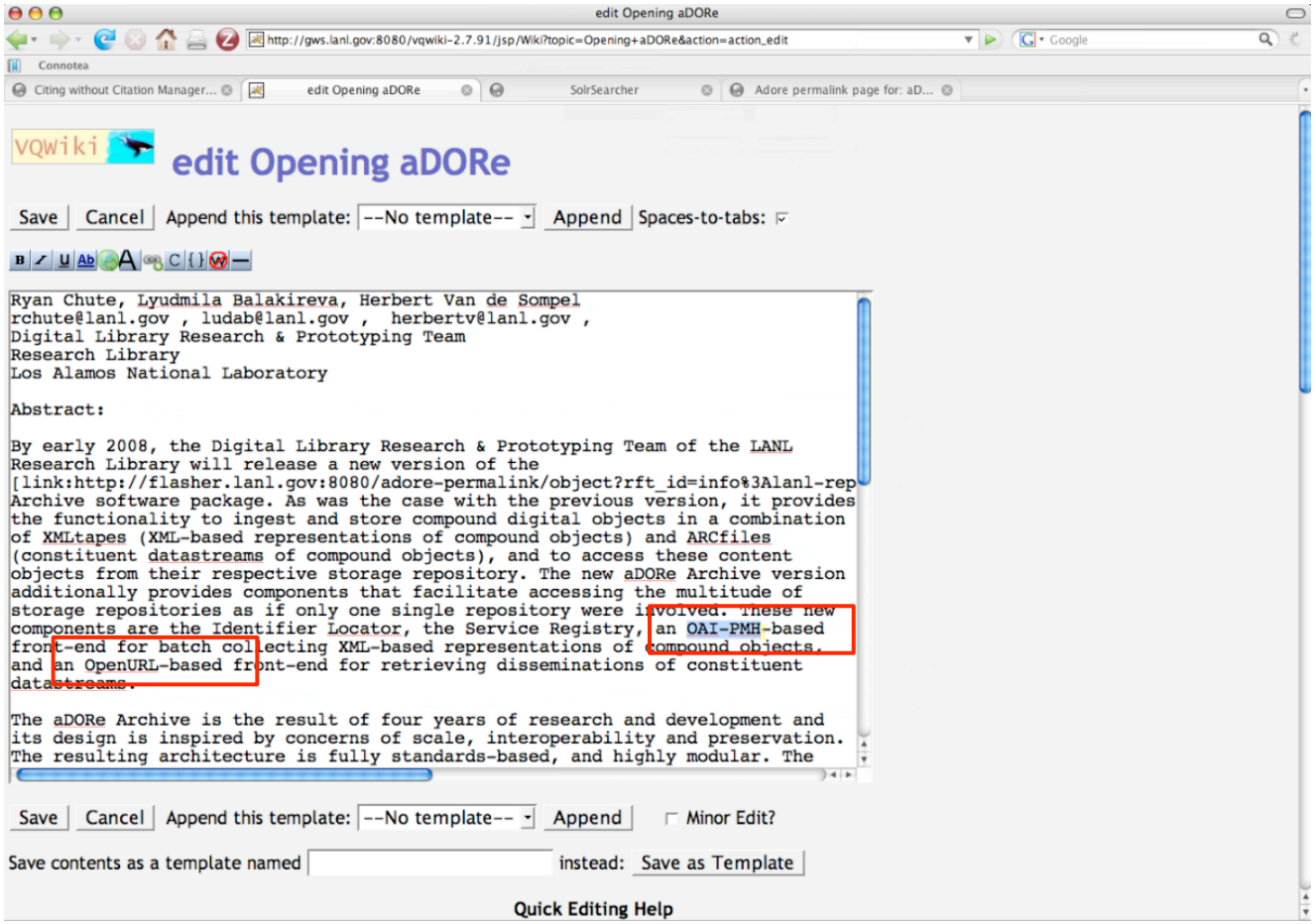
Copy URI of Splash Page



Hyperlink selected area with Splash Page URI



Repeat for other areas that require a citation

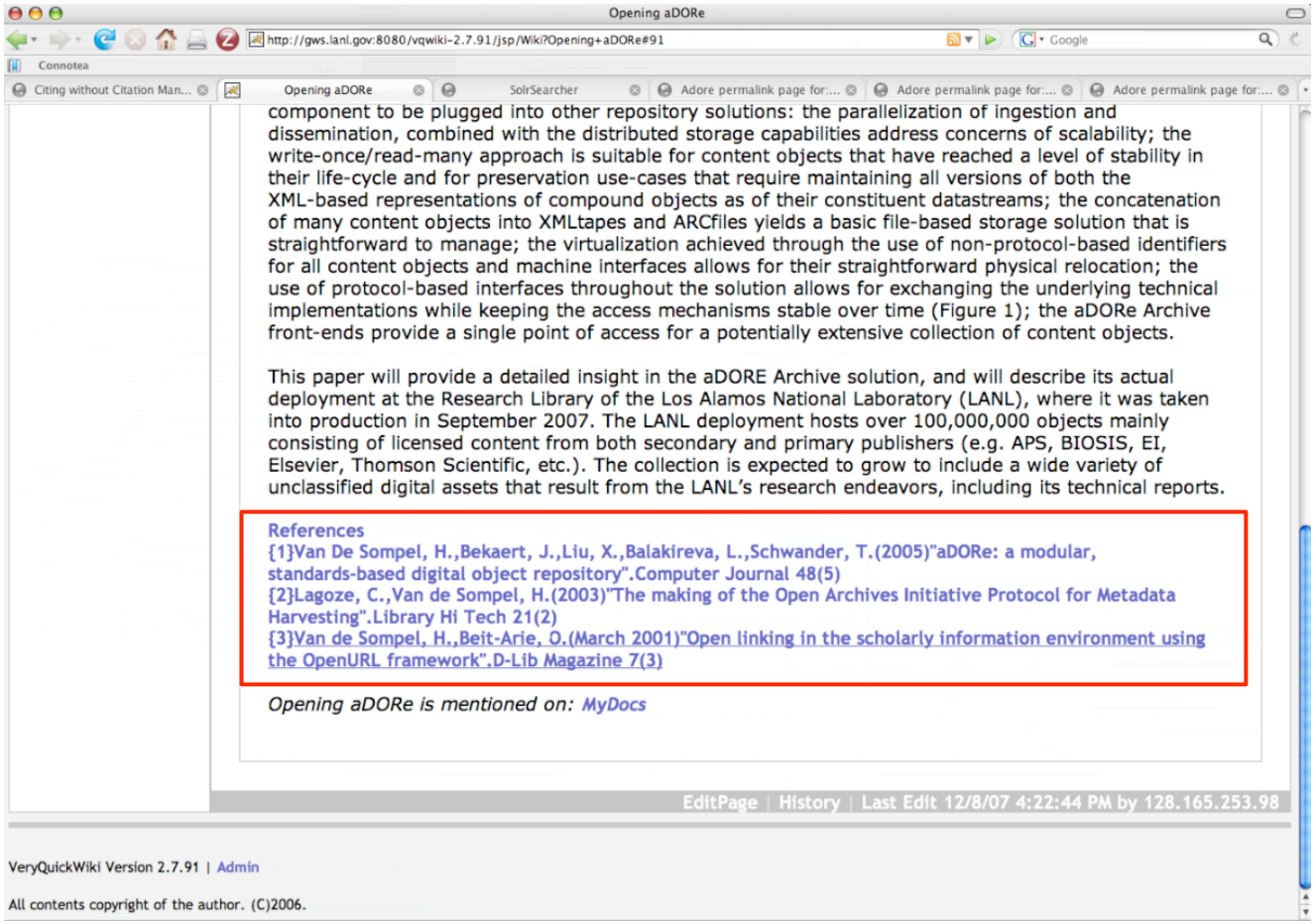


Save it

The Save process follows URIs searching for Resource Maps; structured bibliographic descriptions

Links to Splash Pages, *References* section inserted

References section completed



OAI Object Reuse and Exchange: Acknowledgments

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OAI Object Reuse and Exchange

More Details

OAI Object Reuse and Exchange: Advanced 1

Multiple Resource Map Serializations

Authoritative Resource Maps

`e.g. HTTP 303`

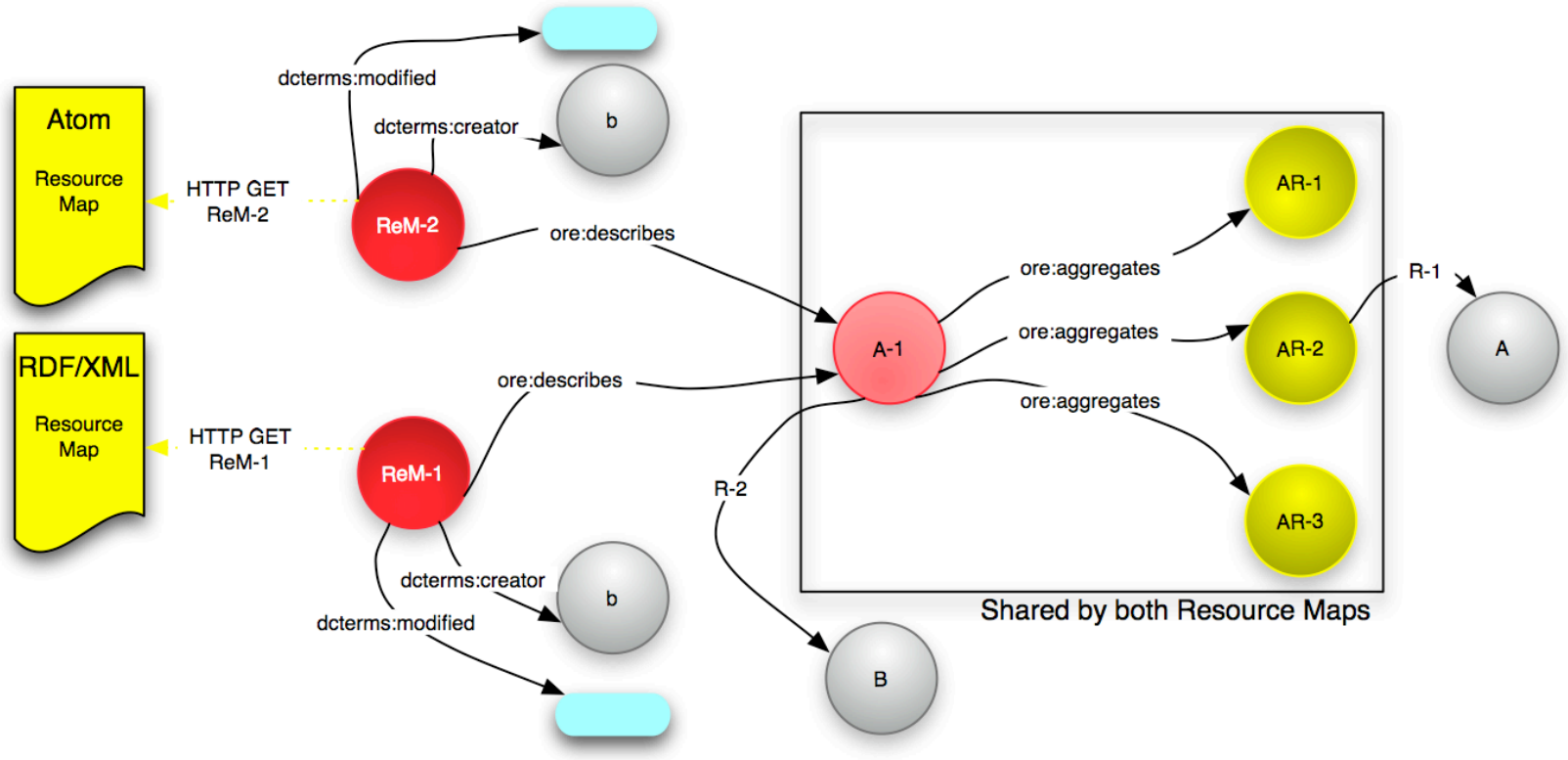
Discovery of Resource Maps

`ore:isDescribedBy`

Relationship between Aggregation and Resource Map

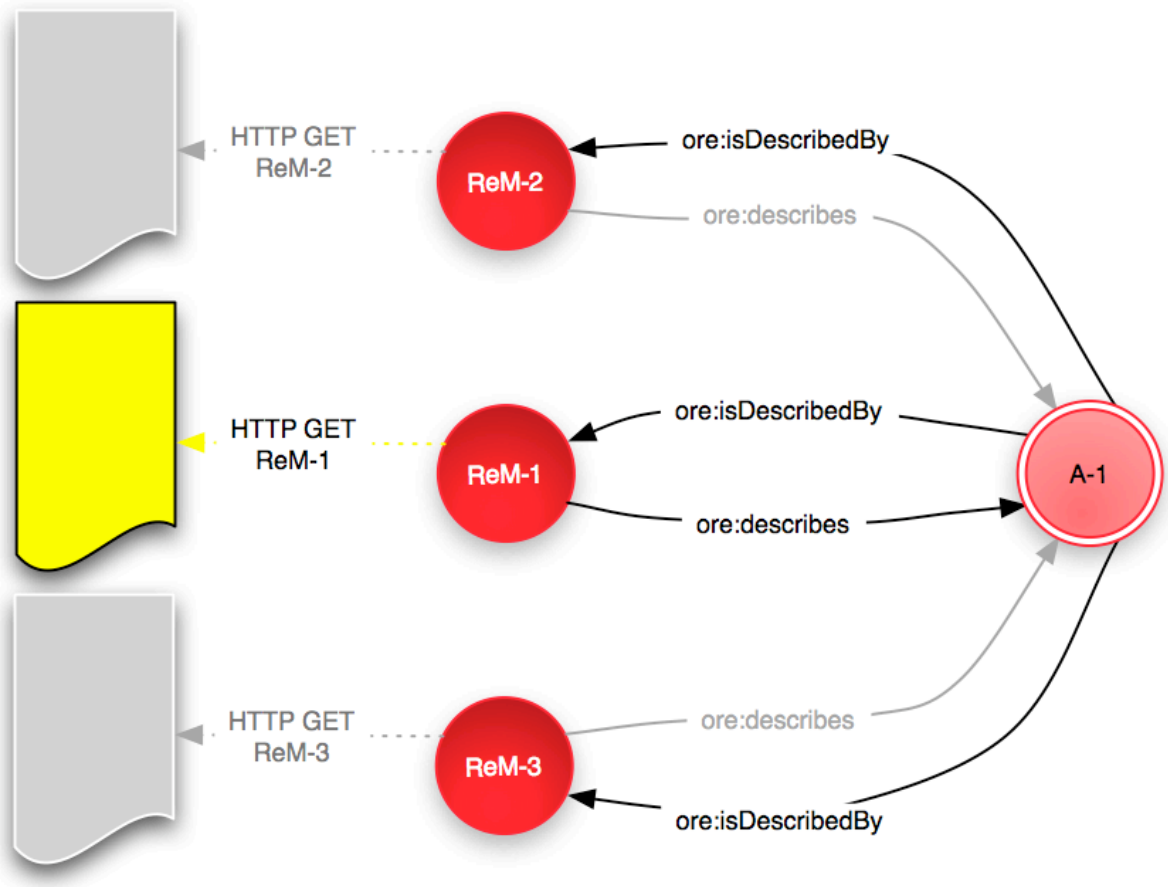
- An Aggregation is a Resource with a URI
- A Resource Map is a Resource with a URI
- A Resource Map asserts (provides identity for) and describes one Aggregation
  - A Resource is an Aggregation due to an assertion by (at least) one Resource Map
  - A Resource Map must have one representation

Multiple Resource Maps for an Aggregation; serializations



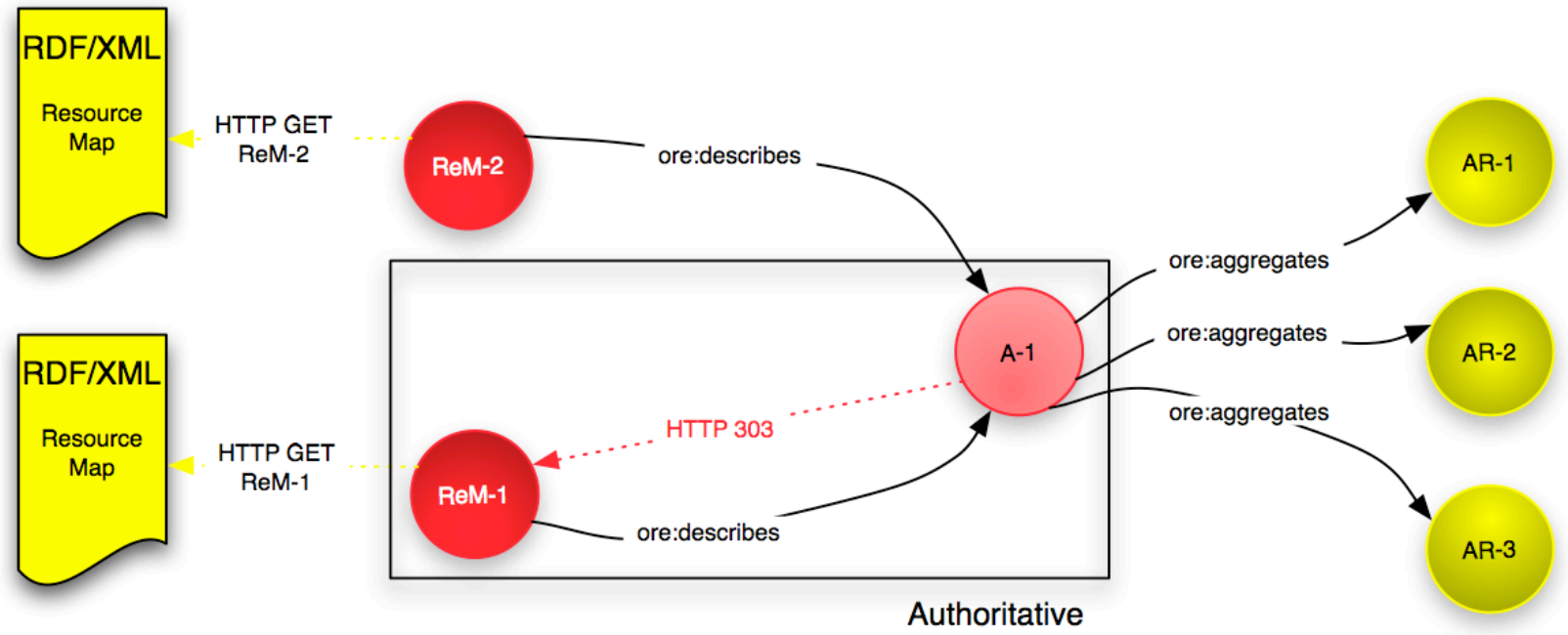
Aggregation Graph shared by both Resource Maps. Also Proxies shared (later).

Multiple Resource Maps for an Aggregation; discovery



Use `ore:isDescribedBy` to facilitate discovery of other Resource Maps

Multiple Resource Maps for an Aggregation; authoritative



Authoritative: dereference of URI of Aggregation leads to Resource Map

Authoritative and. Non-Authoritative Resource Maps

- Authoritative
  - Created by same authority (usually)
  - Must be minimally equivalent (same Aggregated Resources and Proxies)
  - Should assert mutual existence (`ore:isDescribedBy`)
- Non-authoritative
  - Best practice is to not create them
  - Assert your own Aggregation instead
  - Use `rdfs:seeAlso` to assert relationship between two Aggregations

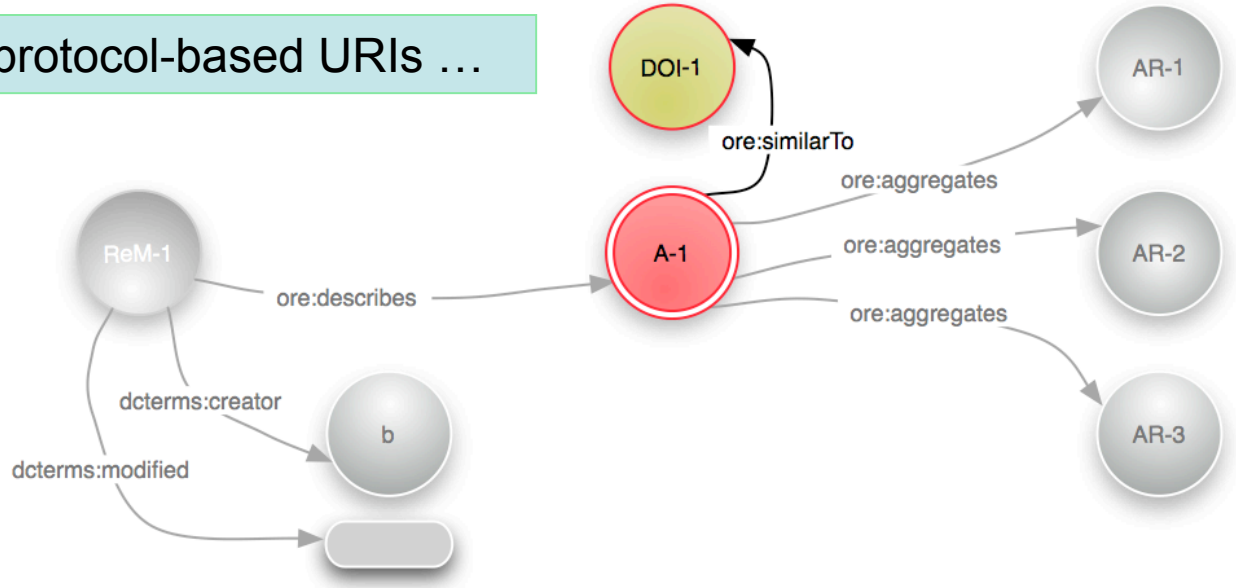
OAI Object Reuse and Exchange: Advanced 2

Expressing non-protocol-based URIs

`ore:similarTo`

The `ore:similarTo` relationship

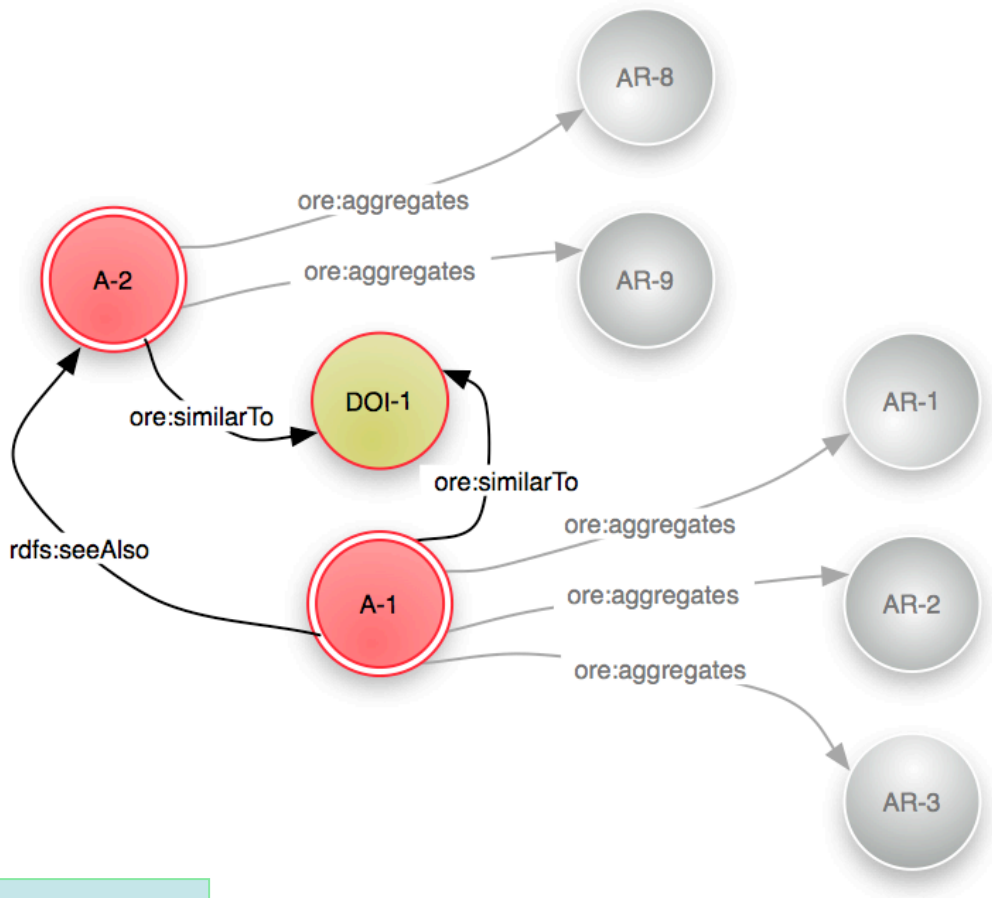
To express non-protocol-based URIs …



<A-1>	<ore:similarTo>	<DOI-1>

A-1	http://www.dlib.org/dlib/february06/smith/aggregation
DOI-1	info:doi/10.1045/february-2006-smith
ore:similarTo	http://www.openarchives.org/ore/terms/similarTo

The `ore:similarTo` relationship



DOI-1 connects the graphs

The bigger message re URI-A

- Mint a new URI-A for an Aggregation
  - Use a HTTP URI
- And mint new URI-Rs for Resource Maps that describe the Aggregation
  - Use HTTP URIs
- Do not overload:
  - The DOI
  - The splash page URI-S

  by turning them into URI-A.
- Rather express relationships between those URIs and URI-A:
  - `URI-A ore:aggregates URI-S`
  - `URI-S rdf:type info:eu-repo/semantics/humanStartPage`
  - `URI-A ore:similarTo DOI-1`


OAI Object Reuse and Exchange: Advanced 3

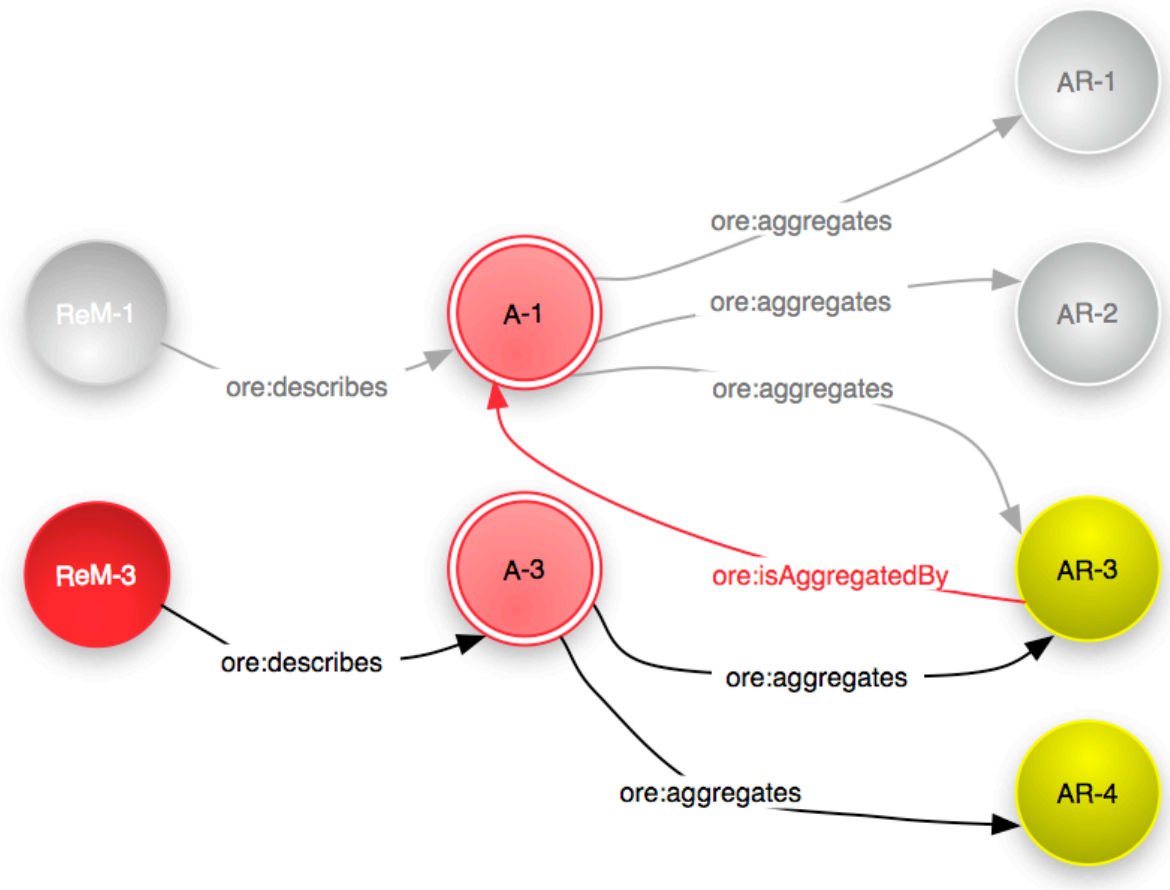
Aggregated Resource member of another Aggregation

`ore:isAggregatedBy`

Aggregated Resource is an Aggregation

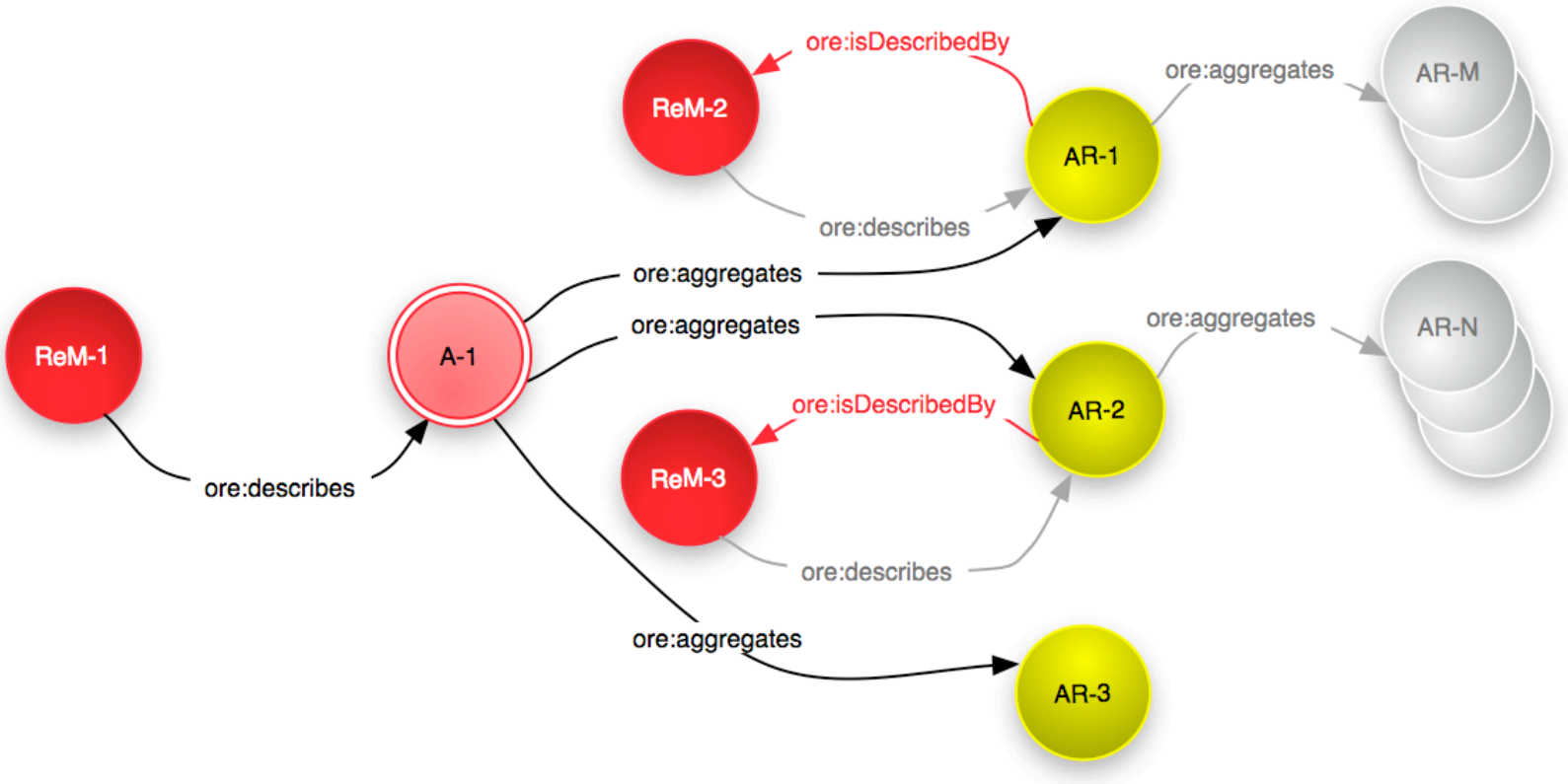
`ore:isDescribedBy`

A resource is an Aggregated Resource is another Aggregation



Use `ore:isAggregatedBy` to express membership of another Aggregation

An Aggregated Resource is itself an Aggregation



Use `ore:isDescribedBy` to point at a Resource Map that describes that Aggregation

OAI Object Reuse and Exchange: Advanced 4

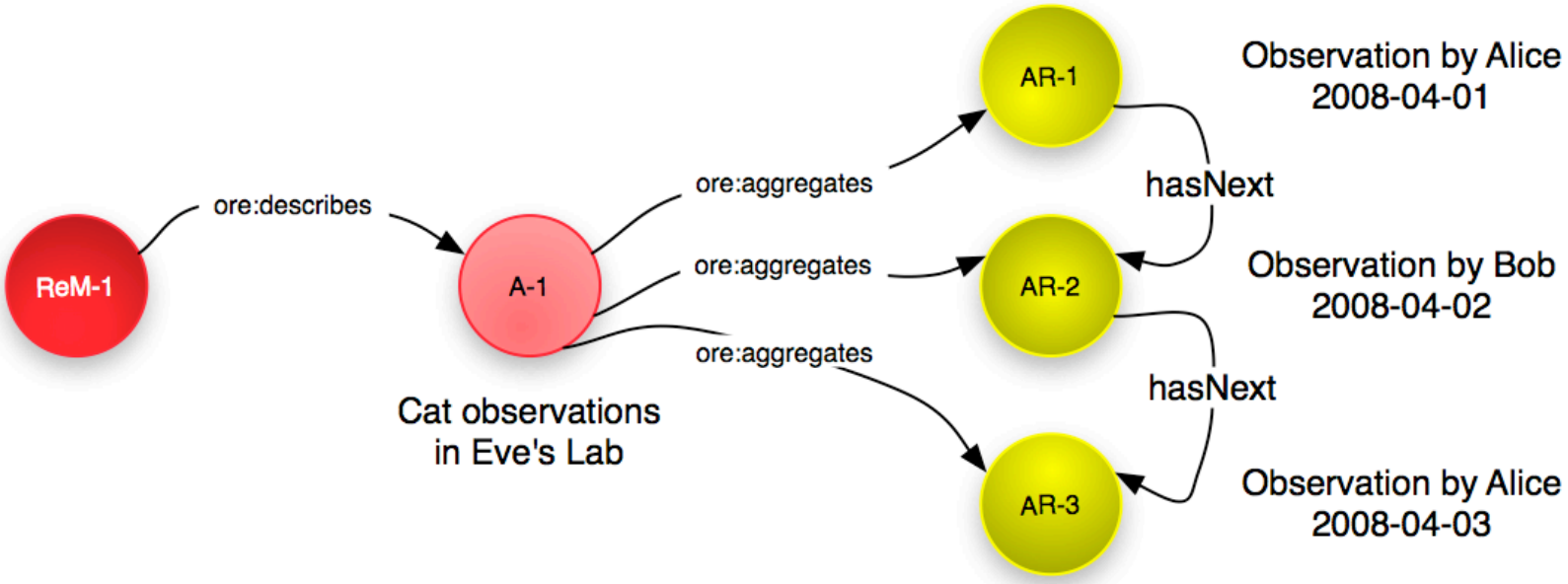
Proxy: Aggregated Resource in Context of an Aggregation

`ore:isProxyFor`

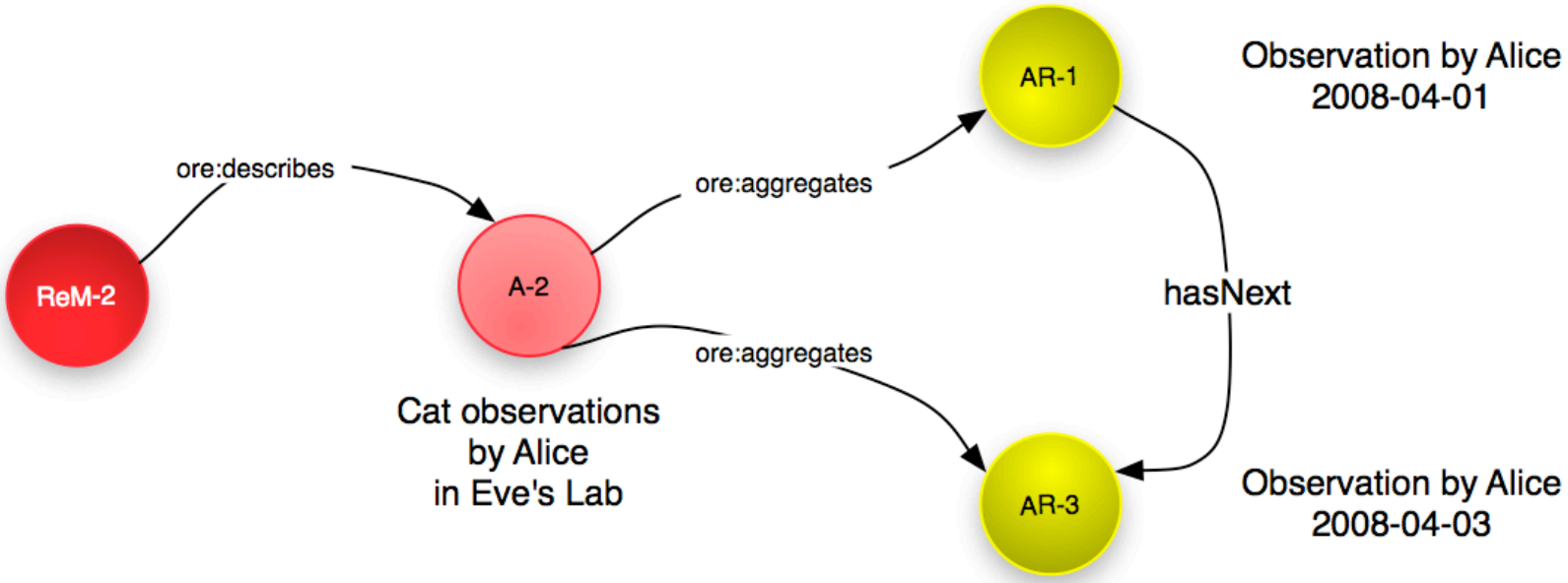
`ore:isProxyIn`

Alice and Bob observe cats in Eve's Lab

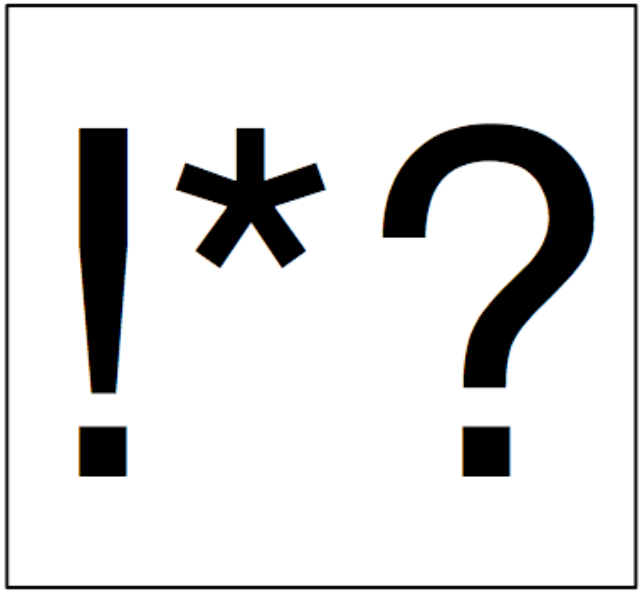
Alice and Bob observe cats in Eve's Lab



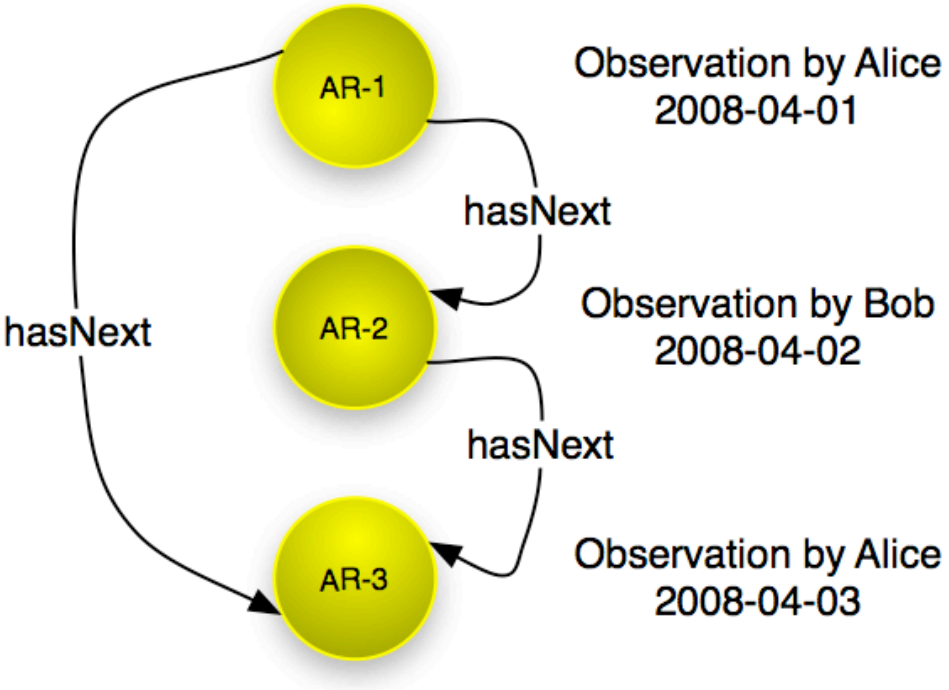
Alice observes cats in Eve's Lab



An agent merges information and gets confused



What the heck!



What did we mean by hasNext?

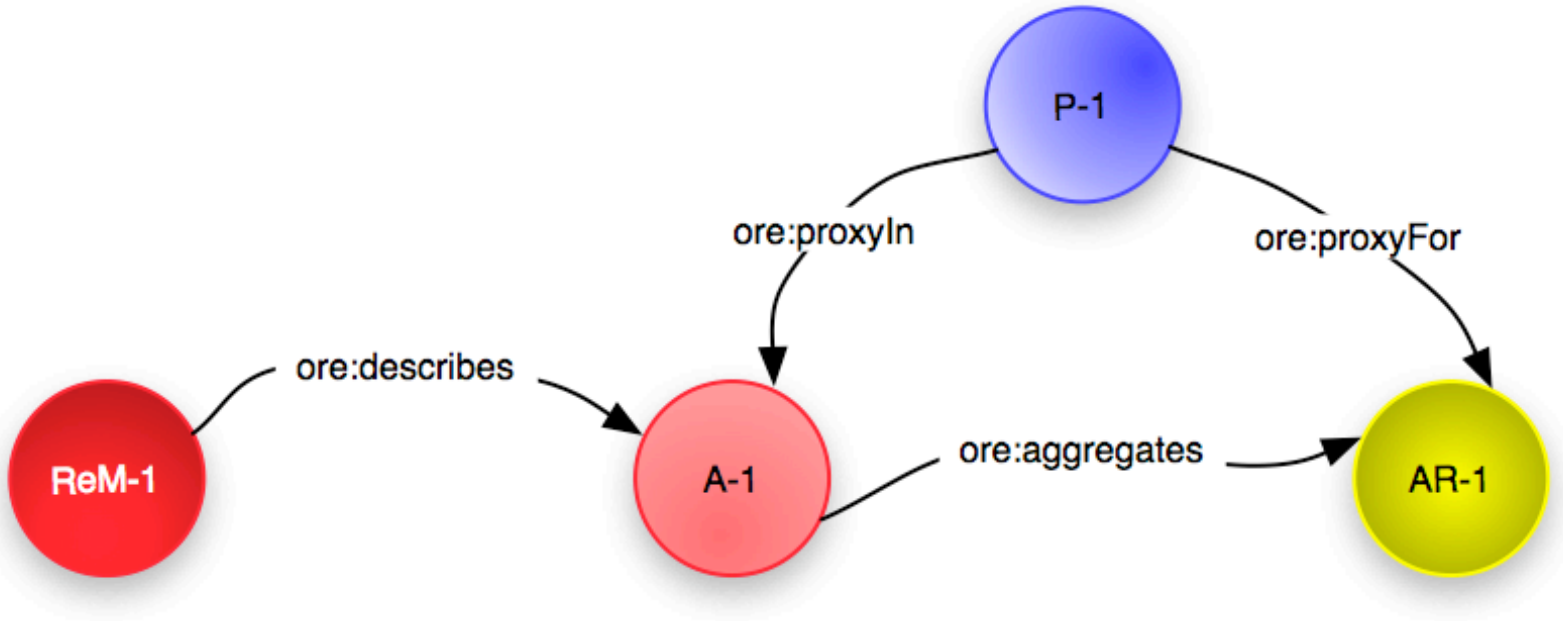
- Resource Map 1: Bob's observation on 2008-04-02 is the next observation after Alice's observation on 2008-04-01 in the sequence of observations in Eve's Lab

- Resource Map 2: Alice's observation on 2008-04-03 is the next observation after her observation on 2008-04-01 in the sequence of Alice's observations in Eve's Lab

Modeling a Resource in the Context of an Aggregation: Proxy

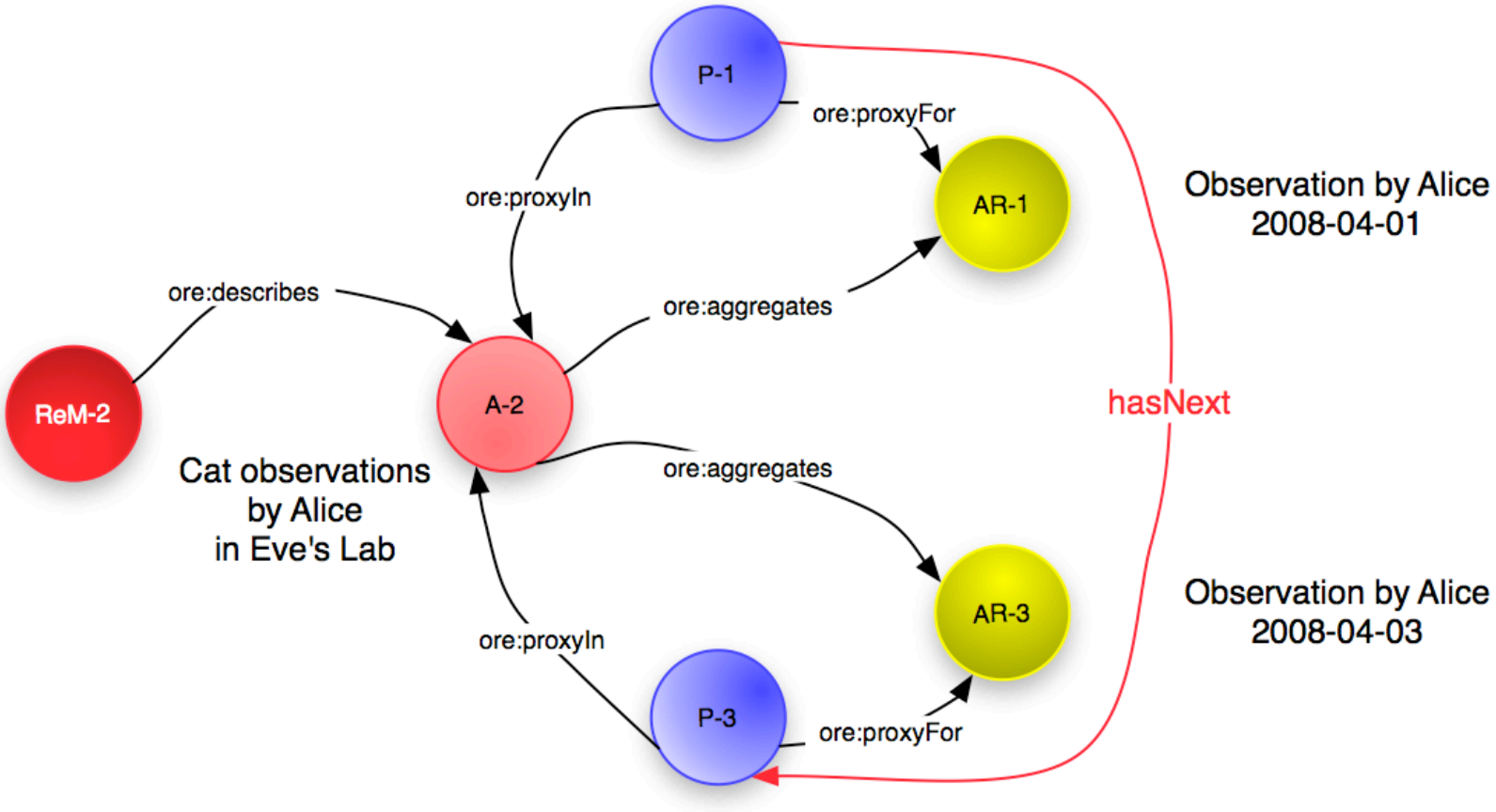
- Two components:
  - The (Aggregated) Resource
  - The context in which it is aggregated, i.e. the Aggregation
- In the Web Architecture, a new concept needs a new resource (and hence URI): we named it the Proxy

Modeling a Resource in the Context of an Aggregation: Proxy



`ore:proxyFor` and `ore:proxyIn` to introduce a Proxy for an Aggregated Resource

Alice's observations in context



`hasNext` expressed as a relationship between Proxies

Citation to a resource in a specific context